State of California
State Water Resources Control Board

STATEMENT OF REASONS ADDRESSING:

RULEMAKING BY THE STATE WATER RESOURCES CONTROL BOARD TO REGULATE ONSITE WASTEWATER TREATMENT SYSTEMS FOR THE PROTECTION OF SURFACE WATER AND GROUNDWATER

November 2008

GENERAL PROJECT SCOPE AND APPLICABILITY

REASON FOR RULEMAKING

On September 27, 2000, Assembly Bill 885 (**AB 885**) was chaptered into law. AB 885 added Chapter 4.5 (Section 13290 to 13291.5) to Division 7 of the California Water Code (**CWC**) and requires the State Water Resources Control Board (**SWRCB**) to adopt regulations or standards for the permitting or operation of onsite wastewater treatment systems (**OWTS**). The standards or regulations, developed after consultation with stakeholders, are targeted for application to new OWTS and existing OWTS. The statute requires that the regulations or standards shall include, but are not limited to:

1. minimum operating requirements;
2. requirements for OWTS adjacent to water bodies identified as impaired pursuant to Section 303(d) of the Clean Water Act;
3. requirements for authorizing local agencies to implement the State regulations or standards;
4. requirements for corrective action;
5. minimum requirements for monitoring to determine performance, as applicable;
6. exemption criteria to be established by the Regional Water Quality Control Boards;
7. requirements for determining when a system is subject to major repair.

The statute allows the California Regional Water Quality Control Boards (**Regional Water Boards**) and local agencies to adopt or maintain standards that are more protective of water quality and public health than the regulations promulgated by the SWRCB.

The proposed rules are a result of evaluating past performance of OWTS in California, as managed under the current system. The SWRCB and the nine Regional Water Boards are the state agencies assigned the responsibility and statutory authority, under the Porter Cologne Water Quality Control Act (Division 7 of the CWC, commencing with Section 13000, hereinafter referred to as Porter-Cologne), for protecting surface water and groundwater from unreasonable degradation resulting from discharges of waste. Pursuant to CWC Section 13260, persons discharging or proposing to discharge waste that could affect the quality of waters of the state, other than discharges into a community sewer system, must file a report of waste discharge unless waived under specified circumstances. Regional Water Boards issue water discharge permits (waste discharge requirements or WDRs) implementing regional water quality control plans that protect beneficial uses of receiving waters. Porter-Cologne provides no statutory exemption from the State's water quality permitting process for discharges of wastewater from OWTS.

Nevertheless, the SWRCB and Regional Water Boards have not generally issued wastewater discharge permits for OWTS. Instead, Regional Water Boards have waived requirements for submission of reports of waste discharge and issuance of WDRs, as allowed under CWC Section 13269, for all but the largest OWTS. Large OWTS have been found to have higher failure rates (Plews and De Walle 1985). Some information indicates that the failure of larger OWTS occurs because they are improperly sited and designed due to the assumption that they are no different than the smaller OWTS (USEPA 1999). CWC Section 13269 allows the State Water Board or regional water boards to adopt such waivers, provided that it is in public interest, among other requirements. When issuing waivers, the Regional Water Boards have previously relied upon local health agencies to perform oversight and regulation in a manner that provides water quality protection. However, this approach affords no statewide uniformity and has not always protected water quality (SWRCB 1994).

Recent changes to CWC Section 13269 now require that conditions for issuance of waivers include monitoring unless it is determined that the discharge does not pose a significant threat to water quality. On the contrary, studies have shown that OWTS can and do pose a threat to water quality (Woessner and Ver Hey 1997). As a result, and as required by CWC Section 13291,the SWRCB proposes rules applying to both new OWTS and existing OWTS, including requirements for monitoring of such discharges.

BACKGROUND

California has approximately 1.2 million OWTS currently operating. Those 1.2 million serve as sewage treatment and disposal systems for approximately 10% (3.4 million people) of the State's population. The resultant wastewater flow from those OWTS is estimated at 420 million gallons-per-day. In several counties, more than 40% of the housing units use OWTS (CWTRC 2003). The proper treatment and disposal of this wastewater is important because the majority of it will pass through the soils underlying the OWTS to recharge groundwater (USEPA 2002). Groundwater pollution related to OWTS is occurring and action is needed to minimize future adverse effects on water quality (SWRCB 1994).

With the passage of the Clean Water Act in the 1970's, many believed that it was only a matter of time until most homes with OWTS were served by a centralized collection system (Crites and Tchobanoglous 1998). OWTS adjacent to urban areas were initially constructed with the expectation that they would be used only temporarily until centralized sewers became available. Many anticipated sewer lines were never built. In addition, many OWTS were built to serve vacation properties in remote or difficult locations for centralized sewers. Many of those properties have since become full-time residences.

These facts illustrate why OWTS are now considered a permanent solution for wastewater treatment and disposal in certain areas. Their performance must protect public health and water quality where they are used in the State. OWTS must provide, and continue to provide over the long term, suitable and adequate treatment. However, regulation of discharges from OWTS may appropriately recognize that OWTS are not always able to protect water quality to the fullest extent possible (CWTRC & USEPA-R9).

The standard "conventional" OWTS is a gravity-operated system consisting of a septic tank that receives wastewater directly from a residence or business for wastewater clarification. After clarification of the wastewater by the septic tank, the septic tank effluent passes to the dispersal system field (generally trenches and pits) for percolation down through the soil for final treatment, eventually reaching groundwater. The vast majority of existing OWTS, perhaps as many as 99 percent, are conventional OWTS (CWTRC 2003). While conventional OWTS can effectively reduce pathogens, soluble constituents resistant to biological degradation are not removed. Studies indicate that the effluent reaching groundwater from such systems seldom meets federal drinking water standards (Maximum Contaminant Levels), especially for total nitrogen. Pathogens do pass through the septic tank treatment process and, where dispersal fields are inadequately designed, through the subsurface soils to groundwater intact [Rogers et al. 1988; AZDEQ 1997; USEPA (2002 and 1980)]; Peterson and Ward 1987). Although OWTS effluent, once in the groundwater, will sometimes be diluted so that ambient groundwater is below the Maximum Contaminant Levels, most dilution models used to predict impacts from OWTS are probably physically unrealistic. Plumes extending from conventional OWTS often violate the Maximum Contaminant Levels for nitrogen (Woessner 1987, Robertson 1995).

Supplemental treatment (also commonly referred to as alternative treatment, innovative treatment or pretreatment) provides active treatment prior to the discharge of wastewater into the dispersal field. Accordingly, OWTS with supplemental treatment rely less on the soil for treatment. Supplemental treatment components can be discussed and distinguished by the type of treatment provided (Buchholz 1980, USEPA 2002). However, the proposed rule, and this SOR, will discuss them generally, because all applicable types may be allowed if the systems meet performance requirements.

The use of supplemental treatment systems increases soil wastewater acceptance and minimizes the possibility that untreated or partially treated wastewater will reach sensitive receptors or adversely affect human health (Tyler 1994, USEPA 2002, Carlile 1994). Because supplemental treatment occurs before the wastewater is discharged to the soil, thus providing treatment that usually takes place in the soil for conventional OWTS, OWTS with supplemental treatment components require less soil to provide the similar level of treatment provided by conventional systems. Accordingly, supplemental treatment systems are usually sited where the soil lacks the capacity to treat the wastewater due to soil conditions (either quantity or soil type) or where water passes through the soil very slowly (e.g.: clay soils).

In addition to design variations relating to the absence, presence, and type of supplemental treatment systems, dispersal system designs also vary. Different dispersal systems are chosen based on what best fits the site conditions. Several different types of dispersal system designs are available where the soils are unsuitable for conventional dispersal system types. These dispersal systems are designed to overcome site constraints. Many of these have been authorized by government agencies, including other states and local governments. Such systems include: at-grade systems, mound systems, subsurface drip systems, and evapotranspiration and infiltration systems (Mote 1994, Arizona 2001, Corr 2002, and Santa Cruz 1999).

Until recently, the primary objective of siting and designing OWTS has been that of getting wastewater below the surface (disposal), with consideration of the wastewater treatment as a secondary consideration (Crosby 1998, Bauman 1984). As such, the definition of failure has previously been defined as: 1) when effluent emerges at the ground surface or backs up into the home or business because the dispersal field is too slow to accept the effluent into the soil, or 2) when the applied effluent passes through the soil and flows into the groundwater with pollutant concentrations at levels above water quality objectives (usually total nitrogen and human pathogens, but possibly including other pollutants) (CWTRC, Aug. 2003).

The first type of failure (surfacing of untreated or partially treated sewage) results in the potential for direct sewage exposure to humans. If allowed to run off the surface of the soil, this discharge can reach nearby surface water bodies or into conduits leading to surface waters, thereby polluting those waters (CWTRC Aug. 2003). This type of failure is generally easy to recognize and usually leads to system replacement or repair (CWTRC Jan. 2003).

However, an OWTS discharge that pollutes groundwater is often undetected, even though it is well documented that inadequately treated wastewater from septic systems poses a serious threat to groundwater quality (CA DHS 1999). This type of OWTS failure is far more insidious, given that there is no evidence for it at the land surface and it is more difficult to determine (CWTRC Jan. 2003). It can, however, result in long-term groundwater pollution at the dispersal system and downgradient (in the direction of local groundwater flow), impairing the beneficial uses of groundwater at existing and potential future downgradient wells (Driscoll 1986, Fetter 1988, Robertson 1991). Dissolved contaminants from OWTS discharges have been shown to travel in groundwater for hundreds of feet and to exceed drinking water standards for nitrates for hundreds of feet as a groundwater plume (Robertson 1991).

OWTS that are located above fractured bedrock pose an especially difficult challenge and threat. From such OWTS, discharges containing dissolved contaminants can travel hundreds of feet in rock fractures in a short time period. The direction of water flow in rock fractures is difficult, if not impossible, to determine (Winneberger 1984). Therefore, although it is common practice to assume that an OWTS is working well so long as it does not show evidence of sewage migration to the surface, research has demonstrated that this assumption may be erroneous due to pollutants released to groundwater in excess of water quality objectives (Robertson 1991).

Conventional OWTS are often neglected and maintained only when failure has occurred or is imminent. This is due in part to the general but erroneous belief that OWTS require little or no maintenance (USEPA 1997). Supplemental treatment components require even more attention to ensure adequate function. It has been found that supplemental systems require periodic maintenance to adequately perform the expected level of treatment (Sexstone 2000). The current statewide regulatory scheme for OWTS includes no requirement for performance evaluation, except in cases where neighbors complain of smells resulting from surfacing effluent. Very few local agencies have permitting programs requiring OWTS maintenance.

Nitrogen compounds remain a problem, even in OWTS that function as designed. Conventional OWTS and OWTS with supplemental treatment components that are not designed to reduce nitrogen are likely to cause nitrate pollution (USEPA Onsite Wastewater Treatment Manual 2002, Robertson 1995). The septic tank's anaerobic environment reduces most of the nitrogen in the wastewater into ammonia compounds (Ball 1994). Septic tanks do a good job of providing this conversion. However, this does not substantially remove any nitrogen. In order for nitrogen to be eliminated from the waste stream, the ammonia must be oxidized to the nitrate form (a process called "nitrification") and then converted, through another process (called "denitrification") to gaseous forms of nitrogen compounds, principally nitrogen gas and nitrous oxide, which can escape from the wastewater and move into the atmosphere (Tchobanoglous 1991). The in-soil treatment (below the dispersal system) is ideally suited to the aerobic nitrification process, but the problem is that the final step (denitrification) requires anaerobic conditions, plus a carbon source. Unfortunately, after passing through the first two steps, the wastewater does not usually contain the carbon-rich constituents necessary for denitrification and also does not usually have anaerobic zones available to it to complete the reduction of nitrate to gaseous forms of nitrogen before the waste stream reaches groundwater.

Therefore, once the nitrates reach groundwater, they constitute a nearly permanent contribution to the area's groundwater nitrate loading (CWTRC 2003; USEPA 2002; Geary et. al. 2001). As such, nitrates pollute groundwater beneath OWTS and have been shown to travel for hundreds of feet as a plume (Robertson 1991). This fact raises questions about the appropriateness of the conventional approach used to address nitrate pollution by using groundwater basin mixing models. Once local groundwater exceeds the federal and California Maximum Contaminant Level for nitrate (10 mg/L as N), it poses a health threat if ingested by infants (Tchobanoglous 1991).

The Regional Water Boards have identified several large areas within the State where nitrate and, in some cases, pathogen pollution from poorly performing OWTS have impaired the beneficial uses of groundwater (CWTRC 2003). Approximately forty percent of the houses that rely upon an OWTS also draw their drinking water from groundwater in close proximity to the OWTS discharge (CWTRC 2003). Even if the well at a particular property is not downgradient from the OWTS serving that property, there may be nearby wells servicing other houses, toward which the wastewater moves. In this context, nitrates and human pathogens pose the greatest threat to human health. With little or no knowledge of the local groundwater gradient beneath the site, it is a questionable practice to install an OWTS and assume that it poses no human health threat to people with wells immediately downgradient.

Given the potential threat posed by OWTS and their widespread use, the SWRCB proposes minimum new standards for the design and operation of new OWTS and minimum monitoring requirements for new OWTS and existing OWTS. The SWRCB's goal is to ensure that the discharge from new OWTS is relatively free of pathogen indicators prior to the discharge reaching groundwater. While reducing other constituents, such as nitrates, that are likely to pollute groundwater, is feasible with commercially available supplemental treatment, widespread use of such technologies has not occurred to date.

Where a Regional Water Board has determined that OWTS contribute to the impairment of surface water bodies, the goal is to minimize pollution from both new and existing OWTS and, where feasible, reverse the impairment of affected surface water bodies. Statewide minimum standards are necessary to protect surface water bodies because local and regional requirements may be waived for various reasons, including perceived economic hardship.

The proposed regulations include requirements for proper siting of new OWTS. Because the elevation of groundwater can fluctuate by as much as 15 feet (Laak 1986), the proposed regulations contain minimal prescriptive requirements for siting new OWTS, except where the groundwater has been determined to be greater than 10 feet below the ground surface. To achieve effective reduction of pathogens, the goal of this requirement is to keep an unsaturated zone between the bottom of the dispersal system and the seasonal high groundwater to ensure proper OWTS function. The proposed regulations would require a minimum of three feet of separation from groundwater for conventional OWTS and two feet for OWTS using supplemental treatment, since it has been found that a 2 to 4 foot separation is necessary to provide adequate treatment of the effluent for pathogen reduction (USEPA 2002).

The proposed regulations include design standards for new conventional and new supplemental treatment systems and dispersal systems. Many of these are standards that are not new to the industry, but currently are not required uniformly throughout the State. The proposed regulations therefore establish a statewide minimum baseline set of requirements.

The design standards for septic tanks are based upon Appendix K of the California Plumbing Code (**CPC**), already required in some parts of the State. The California Housing and Community

Development Department has adopted Appendix K as part of the California Code of Regulations, Title 24. However, the CPC is not required for one- and two-family dwellings or where alternate facilities or installations have been approved by the applicable local government authority. These proposed regulations would therefore establish statewide minimum standards.

The proposed regulations also would include design requirements that are newer to the OWTS industry, such as effluent screens. Effluent screens are intended to protect the dispersal field from premature failure from neutrally buoyant solids (USEPA 2002).

A variety of supplemental treatment components are available that can address site-specific conditions ("Supplemental Treatment"). These components can provide excellent treatment of wastewater, albeit with the need for ongoing system maintenance. For example, percolating the septic tank effluent through a suitably designed bed of peat moss can reduce total nitrogen (all forms combined) by 44-70%, fecal coliforms by over 99%, and the total suspended solids by 97%. In the referenced study, effluent emerging from the peat bed was reported clear and far more suitable for subsurface disposal than the septic tank effluent (RA Patterson 1999; Patterson *et al.* 2001). There exists a wide variety of supplemental treatment technologies on the market (SWRCB, 2002) that can be used individually, or in sequence, to provide improved treatment of domestic wastewater (USEPA 2002, Mokma 2001). The proposed regulations establish performance requirements for supplemental treatment systems rather than prescriptive requirements for specific types of systems.

In cases where the homeowner or business owner has invested in supplemental treatment technology, active maintenance is necessary for proper operation (Spooner et. al, 1998, Loomis et. al. 2004, Eliasson et. al. 2001). In fact, maintenance for such systems, if not performed or if inadequate, may result in their failing to provide the degree of wastewater treatment of which they are capable and may end up causing the same sort of problems encountered with a poorly designed, sited or constructed conventional OWTS (Sexstone, et. al, 2000). For this reason, the proposed regulations would require that all owners of OWTS using supplemental treatment retain a service provider to perform maintenance. These systems are also required to have telemetric alarms to notify the owner and service provider in the event of a system malfunction.

The dispersal system is the last constructed control point for the treatment of wastewater. The proposed regulations require that dispersal systems be designed and installed at the shallowest depth where aerobic treatment is enhanced by chemical and biological treatment processes and require that the dispersal system be sized to operate at levels close to or below the long-term acceptance rate. The long-term acceptance rate is the rate at which the OWTS effluent will drain indefinitely into the soil and the rate of soil clogging process will be equal to the rate of the soil unclogging process (Laak 1986). This requirement is intended to prolong system service duration to eliminate, or at least minimize, the depth of subsurface wastewater ponding in the dispersal field (USEPA 2002). The proposed regulations also contain minimum requirements for each of the several known types of dispersal systems, including: dispersal trenches, mound systems, gravel-less chambers, and evapotranspiration and infiltration systems. The proposed regulations would prohibit the use of cesspools for new and replaced OWTS and restrict the use of seepage pits for new OWTS because they pose an increased threat of pollution (Salvato 1972).

OWTS effluent can impair surface waters by overflowing into such waters or discharging via a hydraulic connection with groundwater. For this reason, the SWRCB proposes to require that both new and existing OWTS comply with performance and monitoring standards by a specified date if they are located close to or may contribute to the impairment of any surface water body that is listed as impaired pursuant to Section 303(d) of the Clean Water Act [33 U.S.C. Sec 1313 (d)]. These requirements would apply only if a Regional Water Board has determined in an adopted Total Maximum Daily Load (TMDL) for an impaired surface water body that OWTS contribute to the impairment of the water body. Abandoning the OWTS and connecting to a public sewer will eliminate the OWTS pollution source emanating from OWTS, so an exemption is included under these circumstances.

Because of the complexity of proper OWTS siting, design and installation, persons responsible for the design and construction of OWTS must have sufficient training to enable them to identify site-specific conditions and situations that may require design changes (Whitehead et al. 1999; Patterson, R.A. 1994). The currently prevailing approach whereby a single design is thought to fit most situations and little or no monitoring and maintenance are required is unlikely to achieve the SWRCB's goal of eliminating OWTS-caused pollution. Therefore, the SWRCB's proposed rule would impose minimum qualifications for individuals who design and construct OWTS. Requiring qualified professionals to perform the work will ensure that homeowners installing or updating an OWTS choose individuals with necessary expertise to design and construct a system that will comply with the SWRCB's performance and monitoring standards, even where there are site-specific challenges.

Monitoring is also an important component in the proposed regulations. The regulations would require monitoring of OWTS to assess the need for maintenance and to assess groundwater pollution. Periodic monitoring of the septic tank is essential to ensure that the level of solids retained does not impair the performance of the septic tank. The proposed regulations would specify that the owner have a service provider determine the level of solids in the septic tank every five years. Five years is a reasonable period within which a septic tank might need maintenance for the build-up of excess solids. Since the solids build-up in septic tanks over time is highly variable, the regulations do not require that OWTS be pumped upon every inspection (USEPA 2002, Bounds 1994). However, solids inspections are important because the build-up of solids causes shorter retention times for wastewater in the septic tank and can lead to solids pass-through from the septic tank into the dispersal field, ultimately leading to premature OWTS failure (Bounds 1994). The proposed regulations are intended to maximize the effective life of an OWTS dispersal system.

The proposed regulations also require monitoring to screen for potential groundwater pollution. OWTS contamination of water supplies from pathogens has been identified as causing diseases such as infectious hepatitis, typhoid fever, dysentery, and various gastrointestinal illnesses (USEPA 1977). As discussed previously, pollutants from existing OWTS, such as nitrates, can travel hundreds of feet as a plume in aquifers and as relatively undiluted flow in fractured rock. As a result, OWTS plumes can affect the quality of the drinking water withdrawn from domestic wells (Verstraeten, Ingrid M. 2004). The proposed design and siting standards for new conventional OWTS will reduce pathogens, but not other constituents of concern. For these reasons, the proposed regulations would require OWTS owners with onsite domestic wells to monitor every five years the effect of the OWTS discharge in groundwater downgradient and within 100 feet of the dispersal system. Monitoring well samples would be analyzed for pathogen indicators and inorganic minerals in order to assess potential effects from OWTS. As an alternative to monitoring the OWTS discharge immediately down gradient of the dispersal field, owners may monitor their onsite domestic well to comply with this requirement.

SYNOPSIS OF THE SWRCB'S PROPOSED REGULATORY SOLUTION
TO ADDRESS THE CONCERNS DESCRIBED ABOVE

The SWRCB proposes a regulatory scheme with the following mutually reinforcing focus areas:

1. For new and replaced OWTS, require that the design and installation of OWTS be done by a person technically qualified to recognize and respond appropriately to site-specific challenges, including lack of minimum unsaturated soil depth;

2. For all new OWTS, establish a site evaluation and design process, including minimum siting requirements;

3. For new and replaced septic tanks, require an effluent screen to impede solids greater than a certain size from passing through from the septic tank to the dispersal field;

4. For all new OWTS using supplemental treatment, establish a third party approval process for the supplemental treatment technology, a site evaluation and design process, and performance requirements;

5. For new and rebuilt OWTS, require that the system designer and/or installer provide the site owner with an Operation and Maintenance Manual that describes the as-built plans of the system, the expected nature and frequency of the OWTS maintenance, and (as appropriate) a detailed description of any supplemental treatment installed;

6. For new OWTS, require the dispersal system to be sized so that the wastewater is applied to the soil at or below the long-term wastewater acceptance rate so that it will serve the owner and any subsequent homeowners without premature failure;

7. For new and existing OWTS, require the system owner to monitor the septic tank solids levels every five years to ensure that pumping of the septic tank is done before solids begin to interfere with the operation of the OWTS;

8. For new and existing OWTS with onsite domestic wells, require the system owner to monitor the groundwater every five years, and provide that information to the SWRCB;

9. For new OWTS with supplemental treatment components, require the system owner to arrange for a service provider to conduct maintenance on the system, in accordance with the owner's manual;

10. For areas near an impaired surface water body (as detailed in the discussion of §30040 of this SOR), require new OWTS to meet new performance requirements as specified and, for existing OWTS, require an inspection and report by a date certain to evaluate the OWTS contribution to impairment of the waterbody. If found contributing to the impairment of the waterbody, owners of existing OWTS must, by a date certain, upgrade their OWTS to meet performance standards (see the discussion of §30040 for other options to address this issue); and

11. Establish that the application of this regulatory scheme is the responsibility of the SWRCB or the Regional Water Board, unless or until a qualified local agency enters into a formal written agreement or memorandum of understanding (**MOU**) to implement and enforce the regulations.

SPECIFIC PURPOSES OF THE RULEMAKING

The purpose of this rulemaking is to protect the beneficial uses of groundwater and surface water bodies in the State from degradation resulting from improperly treated wastewater originating from OWTS. The current regulatory scheme is, in many cases, failing to provide such protection.

FACTUAL BASIS

Under CWC Sections §13050, 13169, 13172, 13241, 13260,13282, and 13291, the SWRCB and Regional Water Boards are charged with protecting the quality of waters of the state from discharges of waste to land. The scope of this mandate includes addressing water quality degradation resulting from discharges from OWTS.

There are a number of areas in the State where it is clear that the observed decrease in groundwater quality and/or surface water quality is a result of the poor performance of OWTS operating under the current regulatory scheme (SWRCB 1994). It is reasonable and proper for the Water Boards to impose a technically-effective and cost-effective means of assuring that new OWTS minimize the impairment of waters of the state and, in cases where such impairment is shown to be occurring, minimize and reverse the impairment from both new and existing OWTS.

PROPOSED REQUIREMENTS

Title 27

Division 5. Onsite Wastewater Treatment Systems.

Chapter 1. Onsite Wastewater Treatment Systems (OWTS).

Article 1. Definitions.

Including:

§30000. SWRCB -- Definitions.
§30001. Applicability and General Requirements
§30002 General Requirements

SPECIFIC PURPOSE

The specific purpose of this article is to improve clarity of the proposed rules by establishing a narrow meaning for the terms of art, establishing which OWTS are subject to these draft regulations, establishing basic requirements necessary for construction, operation, and monitoring of OWTS, and establishing basic requirements to be followed by owners of OWTS.

FACTUAL BASIS

Definitions should not contain any substantive requirements, for that is not their purpose. Rather, the use of carefully defined terms of art improves the clarity of the substantive requirements in which they are used. SWRCB staff provides the following discussion for each of the proposed terms of art in order to help validate their necessity and the manner in which they provide clarity.

From a practical standpoint, it is in the State and local governments' interest to ensure that OWTS are designed in a manner to provide both the longest service life possible and the protection of water quality and the environment. OWTS that are designed to function in accordance with these regulations and that are maintained in that state of operation will reduce OWTS-related water quality degradation to the lowest level that is currently achievable economically.

The SWRCB proposes to require the following new regulatory scheme that ensures that the OWTS will meet all site-specific conditions and challenges:

- **Competent Site-Specific Design —** Require that the homeowner or business-owner proposing to install a new or replacement OWTS engage an OWTS professional who identifies relevant site-specific conditions, waste type, and other challenges, and who is capable of developing designs that will work well under those site specific conditions, despite the identified challenges;
- **Owner's Manual Required —** Require the contractor to provide an owner's manual for the OWTS so that the homeowner or business-owner will have the full disclosure of the workings of his/her system. The OWTS owner may then provide the O & M manual to service personnel who might need the information to provide service or repair.

- **Professional Installation —** Require that the OWTS be designed and installed by OWTS professionals, and that they include an as-built plan in the Owner's Manual (see below);
- **Owner Records Retention —** Require the OWTS owner to retain the record plan ('as-built drawings') and any inspection records throughout the life of the OWTS.
- **Service Providers** — For an OWTS with supplemental treatment components, require maintenance using service providers.
- **Septic Tank Monitoring**---Require that the OWTS owner hire a service provider to inspect the septic tank every five years to ensure that solids buildup does not impair the performance of the OWTS.
- **Groundwater Monitoring**---Require that an OWTS owner with an onsite domestic well either monitor the groundwater immediately downgradient from the OWTS discharge or alternatively monitor the onsite domestic well for indicators of pollution from the OWTS.

The SWRCB's proposed OWTS regulatory scheme does not reject any existing or potential future design aspect or component. Instead, it requires that new and replaced OWTS be designed, installed, operated, and maintained properly, in accordance with specified requirements. Further, it requires that where groundwater is beneficially used in the immediate vicinity of the OWTS that groundwater be monitored or alternately, that the onsite well be directly monitored.

§30000. Definitions.

"**At-grade system**" **—**This term is necessary to provide a succinct, clear reference for a specific type of OWTS dispersal system. Although this term is in common usage with OWTS designers, it is important to ensure that all readers of the proposed regulations share an understanding of its meaning.

"**Basin plan**" **—** This term provides a succinct reference to the applicable water quality control plan that has been adopted by the Regional Water Board, approved by the State Water Resources Control Board, and approved by the Office of Administrative Law. The basin plan is applicable within a specific region (boundaries of each region are described in the CWC) and identifies surface water and groundwater bodies within those boundaries along with establishing, for each, its respective beneficial uses and water quality objectives. This adopted plan helps provide the reader with a clear indication of the context within which Regional Water Board staff will view the performance of existing or proposed OWTS.

"**Bedrock**" — Although a common term, this definition is necessary to narrow the scope of its meaning in these draft regulations, to include a specific definition.

"**Certification**" — Without a clear definition, this term has too broad a scope in common parlance to convey the meaning that the SWRCB wishes to convey with its use in these draft regulations.

"Cesspool" — Although this is a common term in civil engineering, it still is confused with similar, but different, types of OWTS. This definition is included to ensure clarity.

"Clay" — The term needs to be defined in order to distinguish it from the other soil particle size-classes.

"**Community water supply**" **—** This term is used in association with the monitoring requirements and needs to be defined in these proposed regulations to improve clarity by depicting the narrowed scope of meaning intended. Although a common civil engineering term, its common dictionary meaning is not specific enough for these proposed regulations.

"**Conventional system**"**—** The term is needed to provide a clear description of the standard type of OWTS.

"**Dispersal system**" **—** Although this has become a common term in the OWTS industry, it may not be in common usage for other readers of the proposed regulations, and its meaning would not be clear from the dictionary meanings of its constituent words.

"**Domestic wastewater**" **—** Although this is a common term in civil engineering, it may not be in common usage for all readers of the proposed regulations and its meaning would not be clear from the dictionary meanings of its constituent words.

"**Domestic well**" **—** This term is used in the discussion of the monitoring requirements and needs to be defined in these proposed regulations to ensure clarity. Although it is a common civil engineering term, its common dictionary meaning is not specific enough to ensure clarity.

"**Dosing tank**" **—** Although this is a common term in civil engineering, it is not a term of common usage for other readers of these proposed regulations, and its meaning would not be clear from the dictionary meanings of its constituent words.

"**Earthen material**" **—** Although a common term, this definition is necessary to include in the proposed regulations for the purposes of clarity when discussing its composition (rock and soil).

"**EDF**" **—** This cross-reference is included in the proposed regulations so that all readers can quickly access the defined term in the definitions.

"**Effluent**" **—** Although this is a common term in civil engineering, it may not be common for other readers of the proposed regulations, especially as it would pertain to an OWTS or portion thereof. The definition also helps to distinguish such flows from the raw wastewater that enters the upstream component of the OWTS treatment train.

"**Electronic deliverable format**" **(EDF) —** This term, or its acronym, is necessary to provide a clear, succinct reference to the format requirements for the SWRCB database where all groundwater quality data is stored.

"**Engineered Fill**" **—** This term is necessary to provide a succinct, clear reference to that type of OWTS dispersal system. Outside of these regulations, the term is used in a manner that is too broad. This definition narrows the scope of the term to ensure proper clarity in the proposed rule.

"**Escherichia coli**" **—** This is a common technical term among scientists, civil engineers, geologists, and health professionals. However, it is defined, herein, to help ensure that all readers share a common understanding of the term's meaning, as used within these proposed regulations.

"**ETI" —** This cross-reference is included in the proposed regulations so that all readers can quickly access the defined term in the definitions.

"**Evapotranspiration and infiltration (ETI) bed**" **—** This term is necessary to provide a succinct, clear reference to this type of OWTS dispersal system. Although this term is in common usage with OWTS designers, the definition is important to ensure that all readers of these proposed regulations share an understanding of its meaning.

"**Existing OWTS**" **—** This term is necessary to provide a succinct, clear reference to those OWTS approved or installed prior to the effective date of these proposed regulations. Such systems are subject to different standards than new OWTS or replaced OWTS. Therefore, it is helpful, for clarity, to have a short term that encompasses only these systems.

"**Fines**" **—** This is a common technical term among soil scientists, civil engineers, and geologists for an aspect of soil "texture," but is defined, herein, to help ensure that all readers share a common understanding of the term's meaning, as used within these proposed regulations. It is important to include a definition of this term because soil texture exerts a strong influence upon OWTS design options.

"**Gravel-less chambers**" **—** This term is necessary to provide a succinct, clear reference to that type of OWTS dispersal system. Although this term is in common usage with OWTS designers, it is important to ensure that all readers of these proposed regulations share an understanding of its intended meaning.

"**Grease interceptor**" **—** This term is necessary to provide a succinct, clear reference to a type of OWTS pretreatment device. Although this term is in common usage with OWTS designers, it is important to ensure that all readers of these proposed regulations share an understanding of its intended meaning.

"**Groundwater**" **—** This is a common term having a variety of meanings. The SWRCB is providing a clear, consistent, definition of these subterranean waters for which it intends to provide improved protection with this rulemaking.

"**High-strength waste**" **—** This term is included because such waste requires a higher degree of treatment than does normal household wastewater. These regulations are intended to establish proper treatment of OWTS wastewater and are developed on the basis that the waste being treated is domestic wastewater. Wastewater with higher pollutant strength (e.g. concentrations) requires more treatment if its discharge is to avoid degrading water quality. The concentration–based limits are established from Tchobanoglous and Crites, 1998.

"**Impaired Water Bodies**" **—** This is a technical term in the SWRCB's water quality protection regulatory framework and commonly known in the industry. It is defined herein to ensure that all readers share a common understanding of the term's meaning, as used within these proposed regulations

"**Major repair**" **—** This term is necessary to include in the draft regulations because it is statutorily required pursuant to §13291(b)(7) of the CWC.

"**Memorandum of understanding**" **(MOU) —** This term is necessary to provide a succinct, clear reference to a legal instrument that allows a local agency to assume responsibility for implementing these proposed regulations within its boundary.

"**Mottling**" **—** This is a common technical term among local health agency personnel, soil scientists, civil engineers, geologists and building inspection personnel who regulate OWTS. It is defined herein to ensure that all readers share a common understanding of the terms meaning as used in the proposed regulations.

"**MOU**" **—** This cross-reference is included in the proposed regulations so that all readers can quickly access the defined term in the definitions.

"**Mound System**" **—** This term is necessary to provide a succinct, clear reference to this type of OWTS dispersal system. Although this term is in common usage with OWTS designers, it is important to ensure that all readers of the proposed regulations share an understanding of its meaning.

"**NELAP Accredited**" **—** This is a common technical term among for those knowledgeable in the laboratory science field. However, it is defined herein to ensure that all readers share a common understanding of the terms meaning as used in the proposed regulations.

"**New Lot**" **—** This term is necessary to provide a succinct, clear reference to those lots not recorded by local government at the time of the effective date of the proposed regulations.

"**New OWTS**" **—** This term is necessary to provide a succinct, clear reference to those OWTS not approved or installed at the time of the effective date of these proposed regulations, given that the proposed regulations address these systems differently from existing OWTS.

"**Onsite wastewater treatment system(s)**" **(OWTS) —** This term is defined to improve clarity regarding the type of wastewater treatment systems to which the proposed regulations apply.

"**Percolation test**" **—** This is a common technical term used by local health agency personnel, soil scientists, civil engineers, geologists and building inspection personnel who regulate OWTS. It is defined herein to ensure that all readers share a common understanding of the term's meaning, within these draft regulations.

"**Performance requirements**" **—** This definition is included to provide a clear term for effluent limits from supplemental treatment technology.

"**Permit**" **—** This definition serves to narrow the scope of this common term to encompass only the way in which it is used in these proposed regulations.

"**Person**" **—** This is a common term but is defined herein to ensure that all readers share a common understanding of the term's meaning within these draft regulations. Individuals other than lawyers may misunderstand the broader-than-standard meaning this term has, unless it is defined.

"**Pollutant**" **—** Although this is a common term, it has a very broad meaning for water quality protection purposes and therefore needs to be defined to ensure clarity in these regulations.

"**Pressure distribution**" **—** This term is necessary to provide a succinct, clear reference to a type of OWTS dispersal system. Although this term is in common usage with OWTS designers, it is important to ensure that all readers of these proposed regulations share an understanding of its intended meaning.

"**Qualified Professional**" **—** This term is necessary to provide a succinct, clear reference to professionals that are allowed to perform OWTS siting and design work under these proposed regulations.

"**Record Plan**" **—** This term provides a clear way to refer to the "as-built" construction documentation for the OWTS. It is important to have a record of such details, especially in a case where the property's new owner is unfamiliar with system details.

"**Replaced OWTS**" **—** This term is necessary to provide a succinct, clear reference to those OWTS approved or installed prior to the effective date but, since that time, needed replacement for some reason. Such systems are subject to different standards than unchanged existing OWTS or new OWTS; therefore, it is helpful, for clarity, to have a short term that encompasses only these systems.

"**Rock**" **—** The term needs to be defined because it carries a narrower scope of meaning, in these proposed regulations, than it does in common usage.

"**Sand**" **—** The term needs to be defined in order to distinguish it from the other soil size-classes above and below it.

"**Seepage pit**" **—** This term is necessary to provide a succinct, clear reference to a type of OWTS dispersal system. Although this term is in common usage with OWTS designers, it is important to ensure that all readers of these draft regulations share an understanding of its meaning.

"**Septic tank**" **—** The term's definition provides for its narrow scope of meaning within these proposed regulations and declares the several purposes this basic receptacle serves. Some of these basic services may be unfamiliar to a reader of these proposed regulations who is not conversant with OWTS design and function.

"**Septic tank effluent**" **—** The meaning of this term is known to OWTS professionals; but homeowners and others that may read these proposed regulations may be unfamiliar with this term. Therefore, the SWRCB has defined this term to provide clarity for such readers.

"**Service Provider**" **—** This term is necessary to provide a clear reference to professionals that are allowed to operate and perform maintenance and monitoring work under these regulations.

"**Shallow dispersal system**" — This term is necessary to provide a succinct, clear reference to a type of OWTS dispersal system. The term needs to be defined in order to establish the broadened scope of meaning in these proposed regulations, as compared to its common meaning in OWTS industry usage.

"**Silt**" — The term needs to be defined in order to distinguish it from the other soil size-classes.

"**Site**" **—** The term's definition is necessary to establish its narrower scope of meaning in these proposed regulations, as compared to its meaning in common usage.

"**Site evaluation**" **—** The meaning of this term is known to OWTS professionals; but these proposed regulations will be read by homeowners and others unfamiliar with such matters. Therefore, the SWRCB has defined this term to provide clarity for such readers.

"**Soil**" **—** The term's definition is necessary to provide the reader with a more exacting concept of the term, as it is used in these proposed regulations, than they may have attributed to it in common usage.

"**Soil permeability**" **—** Although this term and its meaning are familiar to geologists, engineers, and hydrologists, its component words may not convey its meaning to other readers of these proposed regulations absent a definition.

"**Soil texture**" **—** Although this term and its meaning are familiar to soil scientists, its component words may not convey its meaning to other readers of these proposed regulations absent a definition. The term, like "soil structure", describes a soil characteristic that exerts a profound influence upon the type of OWTS that can be used at a given site.

"**Supplemental treatment**" **—** This definition is necessary to provide the reader with an exact meaning as it is used in these proposed regulations, since it is not a term of common usage.

"**Telemetric**" **—** This is a common technical term in the OWTS industry and other industries that use remote monitoring. It is defined herein to ensure that all readers share a common understanding of the term's meaning as used within these proposed regulations.

"**Total coliforms**" **—** Most OWTS professionals know this term's meaning. However, homeowners and others that will read these proposed regulations may be unfamiliar with the term. Therefore, the SWRCB has defined this definition to provide clarity for such readers.

"**TMDL**" is an acronym for a technical term in the Federal Water Pollution Control Act and commonly known in the industry. It is defined herein to ensure that all readers share a common understanding of the term's meaning, as used within these proposed regulations.

"**Waste discharge requirement**" **—** This is a technical term in the SWRCB's water quality protection regulatory framework and commonly known in the industry. It is defined herein to ensure that all readers share a common understanding of the term's meaning, as used within these proposed regulations

--------<>--------

§30001. Applicability and General Requirements.

§30001(a) —This paragraph is included in the proposed rule in order to provide a general overview of the Chapter's intent and highlights the relationship that these regulations have with requirements established by local governments and Regional Water Boards when more protective.

§30001(b) — This paragraph provides a clear division of applicability between the two classes of OWTS: existing and new.

§30001(c)(1) and (2) — Experience shows that larger OWTS (greater than 3,500 gallons-per-day) are more likely to fail than smaller ones and that OWTS should be limited to design flows less than 6,000 gallons-per-day (Plews et al. 1985). For this reason, we propose that the State retain the option for direct oversight to ensure that larger OWTS are in compliance with this Chapter and the applicable basin plan. After notification, the Regional Water Board would determine whether to issue specific waste discharge requirements that may be more stringent than required by the proposed regulations.

§30001(c)(3) — OWTS designed to treat a specific type of waste may not be capable of adequately treating other types of waste. Therefore, a change in waste type entering the OWTS may result in adverse effects to the OWTS. Wastewater application rates established in Table 2 and Figure 1 of the proposed regulations assume domestic-strength wastewater. After notification, the Regional Water Board would determine whether to issue waste discharge requirements that may be more stringent than required by the proposed regulations.

§30001(c)(4) — An increase in the hydraulic load above the original design capacity can have an adverse effect on the overall OWTS performance or lead to possible failure.

§30001(d) —This paragraph explains the implementation of these regulations at the State level.

§30001(e) — OWTS regulated by waste discharge requirements (WDRs) are subject to stricter controls and higher levels of regulatory oversight. Accordingly, this increased level of regulatory control is considered more protective than requirements established in the proposed regulations.

§30001(f) — This paragraph explains the mechanism by which these regulations may be implemented at the local level, as provided for by statute.

--------<>--------

§30002. SWRCB - General Requirements.

§30002(a)(1) — The paragraph requires the exclusion of hazardous waste because disposal of such waste in an OWTS would be improper and illegal.

§30002(a)(2) — The paragraph limits the use of OWTS to waste strengths at or below domestic wastewater levels because "the biodegradability of commercial wastes can differ from that of household wastes" (Laak 1986). Also, the effluent soil application rates established in §30014(b) are established by assuming wastewater with domestic waste-strength, since greater or lesser wastewater strengths and hydraulic loading are the two primary parameters that have an effect on how well the OWTS dispersal system operates (Laak 1986). A change in wastewater strength entering the OWTS may adversely affect OWTS performance. Given that even domestic wastewater strength can vary significantly, the upper levels of typical concentrations were selected for use in this definition in order to avoid unnecessarily including domestic wastewater flows that are slightly elevated due to water conservation (Crites and Tchobanoglous, 1998).

§30002(a)(3) — The paragraph allows the use of supplemental treatment components to reduce high-strength wastewater to the level at or below domestic wastewater levels because the effluent soil application rates established in §30014(b) are established by assuming wastewater with domestic waste-strength. Wastewater with stronger concentrations may lead to pollution.

§30002(b) — This is required because OWTS dispersal systems more effectively decompose biologically degradable pollutants and more effectively kill pathogenic organisms in domestic wastewater in an aerobic environment, as opposed to an anaerobic environment (Sauer et. al 1994, Bicki et. al 1991, USEPA 2002).

§30002(c) — This subsection is intended to ensure that new OWTS comply with the provisions of the proposed regulations.

§30002(d) — It is appropriate to limit influent waste streams such that the OWTS can be expected to provide adequate treatment. It is also good practice to require that the designer base the OWTS design upon the quality of wastewater to be treated (Laak 1986).

§30002(e) — In order to ensure protection of the environment, it is essential that all new OWTS or replaced OWTS have good site and soil evaluations, given that this evaluation serves as the basis for the system's design. A qualified professional should perform these site and soil evaluations because such individuals have the necessary skill and experience to recognize and respond to site-specific characteristics that necessitate changes in OWTS design. Site evaluations typically involve inspection of the soil's structure and particle-size distribution (texture), and of how structure and texture vary with depth. It is also important to look for high water marks (indicated by soil mottling) and to identify other site-specific challenges, such as impermeable soils (e.g. clay-pan or caliche layers), slope of the intended leach field area, and other relevant factors (USEPA 2002).

§30002(f) — This approach is necessary because only such a professional will be able to recognize adverse site-specific conditions, which are often subtle, and make design adjustments that are likely to result in the OWTS providing reliable and effective performance. This approach to site evaluation is an acknowledged practice in literature (USEPA 1980). In some counties, the qualified professional, as a representative of the government, may perform the review of site conditions in lieu of a contracted qualified professional. This section is written to allow that practice to continue.

§30002(g) — Proper system installation is just as critical to achieving proper OWTS performance as is proper design. By requiring a contractor to be licensed by the State of California, these proposed regulations assist in keeping unlicensed persons who lack proper knowledge, bonding, and experience from doing work that a State-licensed contractor should provide. In keeping with the standards in building codes, an owner-builder is allowed to install his/her own OWTS.

However, in order to protect water quality, such installations must have a complete post-construction inspection.

§30002(h) — The goal of this subparagraph is to keep OWTS operating properly by prohibiting the discharge of chemicals and compounds that may harm OWTS operation. Biocides are likely to inhibit treatment of wastewater. Also, since 1979, the State has prohibited the manufacture, sale, and use of non-biodegradable toxic chemical substances for use in chemical toilet facilities (Sec. 25210 of the California Health and Safety Code). Wastes from holding tanks, recreational vehicles, and portable toilets are often discharged into OWTS. These discharges should not contain products sold as septic system cleaners, degraders, decomposers, or deodorizers that can interfere with treatment processes, affect biological decomposition of wastes, contribute to system clogging, or pollute groundwater. (USEPA 2002)

§30002(i) — Providing an Operation and Maintenance Manual is an important first step in educating the homeowner about the OWTS. Educating homeowners regarding proper operation and maintenance is an essential element to any OWTS program (USEPA 2002). Availability of an Operational and Maintenance Manual will also allow service providers to find each of the components of the OWTS treatment train and monitoring system.

§30002(j) — It is recognized that the level of management should increase with the complexity of the OWTS. Since supplemental treatment systems usually have mechanical components, it is reasonable to require that a service provider periodically inspect the system and perform routine maintenance and thus ensure that the OWTS is operating in an adequate manner (USEPA 2002).

§30002(k) —The Operation and Maintenance Manual is expected to be essential upon system malfunction and/or when general maintenance is needed. Records on the OWTS type, location, and components are essential for any future work on the system that may be required. The owner of a property with an OWTS must provide the O&M manual to the new owner upon sale so that OWTS information stays with the OWTS site.

§30002(l) —The OWTS owner is required to retain the results of inspections performed for five years as proof that the OWTS is being maintained properly and in compliance with these proposed regulations. Since the proposed rule requires inspections every five years for all septic tanks and monitoring of groundwater in the cases where a domestic well is located on the site, the paragraph requires that the OWTS owner simply keep the most recent inspection documentation as proof of compliance.

§30002(m) — The use of cesspools is prohibited for the protection of the environment and public health. These systems have been known to be a source of pollution due to the lack of treatment of the wastewater (Salvato 1972, USDA 1924).

§30002(n) — Although Appendix K of the California Plumbing Code (CPC 2000) already contains these standards statewide, they are not required for one- and two-family dwellings where alternate facilities or installations have been approved by local government. For that reason, the proposed regulation will create a single minimum standard for one of the major components used in most OWTS designs. Accordingly, the proposed regulations require specific attributes that allow septic tanks and grease interceptors to perform better. Those attributes are as follows:

K5(b): This is a general performance standard (ability to clarify and store settleable matter). If the tanks can't produce this standard, they are useless for their intended purpose.

K5(c): These systems are installed as permanent fixtures. As such, they have to be of sufficient durability to withstand many years of use. A tank that leaks or that accepts infiltrating groundwater may result in OWTS failure.

K5(d): The configuration and dimensions of the septic tanks and grease interceptors are necessary design parameters to ensure proper treatment.

K5(e): Access ports allow maintenance. Such ports need to be large enough to allow for inspections.

K5(k): Buried tanks must not be subject to collapse upon installation.

K5(m)(1): Concrete tanks must meet industry design standards for the purpose of structural integrity and overall performance.

K5(m)(3)(ii): Wooden tanks have been found to be of insufficient durability or quality to meet the above requirements in K5(c) and K5(k).

§30002(o)(1)— In some cases, the access lid on the tank may be more than 2 feet below the ground surface. Rather than backfill over the access ports of the tank with soil, possibly making access difficult to locate the inspection/maintenance ports at a future date, watertight risers are required to be installed for each access opening, and extend up to within six inches of the soil grade. Six inches was determined reasonable, based on the necessary amount of soil needed to sustain grass (CPC 2000, Turfgrass Producers International 2006).

§30002(o)(2) — The access lid for each access opening must be securely capped for the safety of children and pets and to prevent vectors (i.e., flies, mosquitoes, etc.) from entering the septic tank (CPC 2000).

§30002(p) — If a prefabricated tank is to be used, it must have International Association of Plumbing and Mechanical Officials (IAPMO) approval to ensure that it meets the construction standards accepted by the industry. These industry standards ensure proper function of the system. The prefabricated tank must also be installed according to the manufacturer's instructions in order to ensure proper operation.

§30002(q) — In order to use a non-prefabricated tank or non-IAPMO certified prefabricated tank, the construction plans must be certified and stamped by a California registered civil engineer as meeting the general industry standards. Without the certification, the tank has no guarantee that it will withstand the earth loads and other forces acting on the tank or that it will perform to industry standards as required in these proposed regulations.

§30002(r) — Recognizing that effluent solids can cause premature failure of the dispersal system, this section requires that all new and replaced septic tanks be designed to minimize the passage of solids, especially neutrally buoyant solids, into the dispersal field. Filter devices that ensure that no solids with a diameter larger than 3/16 are discharged to the dispersal system are specified because the size of the screen mesh specified in the proposed rule is the only size that is currently certified by an independent third party. The consumer is better protected by certified technologies than otherwise. Requiring such a device, as a standard feature, helps to ensure that the home/business owner's OWTS will provide good performance for as long as possible.

§30002(s)---OWTS are identified as a possible contaminating activity (PCA) for groundwater (CA DHS 1999). OWTS contamination of water supplies is known to cause diseases such as infectious hepatitis, typhoid fever, dysentery, and various gastrointestinal illnesses (USEPA 1977). In fact, a groundwater well in Racine, MO, is known to have caused 28 OWTS-related cases of hepatitis A; and in Richmond Heights, FL, OWTS caused approximately 1200 cases of OWTS-related gastroenteritis from well water (USEPA 1999). Dissolved contaminant plumes from OWTS are known to travel hundreds of feet and exceed drinking water standards. Thus, discharges from OWTS can impair or threaten to impair the beneficial uses of groundwater in the immediate vicinity of the discharge.

The direction of groundwater flow, and thus the direction of the OWTS discharge plume, is generally not known, requires a costly study to determine, and can change substantially due to seasonal variations or groundwater pumping. In a fractured rock environment, it is rarely possible to predict the direction of OWTS discharge flow.

Most, if not all, local ordinances allow domestic wells to be installed as close as 100 feet from an OWTS. Domestic wells are known to be vulnerable to contamination (SWRCB 2007). Domestic wells, as compared to public supply wells, draw water from more shallow aquifers and have less stringent, and thus less costly and less protective construction requirements (DWR 1981). Whereas public supply wells are subject to routine and stringent water quality testing to ensure that the public is not served water that exceeds drinking water standards, no such requirements exist for domestic wells.

For these reasons, the proposed regulations require all OWTS owners with an onsite domestic well located on the property to monitor groundwater either at a monitoring well designed to measure the effects of the OWTS discharge and downgradient of the OWTS (within 100 feet) every five years or, alternatively, monitor their onsite domestic well every five years. The distance of 100 feet is chosen because it provides flexibility for monitoring well placement within the existing landscape. Owners of new OWTS that have an onsite domestic well would be required to monitor the groundwater in the vicinity of the OWTS, or their domestic well, within 30 days after construction of the OWTS. This 30-day requirement is reasonable to establish a water quality baseline against which to measure future monitoring results at the inception of the OWTS discharge.

Monitoring at locations where the groundwater is beneficially used as a domestic water source is useful to the homeowner and to the SWRCB. The monitoring will not only provide the homeowner with an analysis of their own drinking water quality, but will also establish the existing background water quality for broader assessment of the effects of OWTS on water quality. Monitoring of groundwater is not uncommon in the OWTS industry, particularly where groundwater is close to the surface. Drinking water well monitoring is recognized as a valid means of evaluating OWTS performance (USEPA 1980, USEPA 2002, Verstraeten 2004). It is expected that most well owners will monitor their domestic well rather than separately install a monitoring well, or wells, as the latter would be considerably more expensive. Domestic well monitoring will also provide the well owner with useful and public health-related information without the expense of installing additional wells. USEPA recommends that domestic wells be tested annually (USEPA 2002).

Monitoring for changes in the biological and chemical composition of local groundwater is the most cost effective method to evaluate whether OWTS discharges are causing adverse effects on water quality. Analyzing for total coliforms provides an indication of whether the well was vulnerable to contamination by pathogens. Analyzing for minerals commonly found in water provides information of the characteristics of the water and whether wastewater constituents are affecting the water over time. Although less than perfect due to the inherent unknown variability of the subsurface and groundwater therein, this monitoring is necessary for the SWRCB and Regional Water Boards to perform their water quality protection roles.

OWTS owners being served by community water are exempted from this requirement because data on their water systems is monitored and readily available from the California Department of Public Health. Also, the cost for such monitoring would not be offset by a commensurate benefit to the Water Boards or the homeowner, given that there is no direct beneficial use of the groundwater for domestic purposes at such sites.

§30002(t)---It is imperative that the laboratory conducting the water sample analyses required by (s) above is certified by the California Department of Public Health (CDPH), for these laboratories have demonstrated that their output is reliable and accurate. The data, at a minimum, need to be as accurate to the CDPH Detection Limit for purposes of detection limit reporting so that the data generated is comparable both over time and from place to place, as indicated by water quality from various wells, within a given area, and the way each well's water quality changes through time. Over time, the accumulated groundwater quality data provided to the State groundwater database in electronic format will enable regulatory agencies to assess groundwater quality for use in making future water quality protection decisions. This data will also be available to the public, including the homeowners from whose wells water samples and data are represented. However, the names and location of individual homeowners with domestic wells will not be released to the public.

The constituents for analysis were selected upon the basis of which ones would best enable the SWRCB to adequately assess the water quality of the local groundwater resource receiving OWTS discharges. These constituents are commonly analyzed in drinking water. An explanation below describes why the specific constituents are required:

calcium (Ca): The use of water for domestic purposes increases the concentration of minerals and salts in the effluent. Calcium increases in the groundwater can be used to indicate adverse effects from OWTS because calcium is often found in OWTS effluent at concentrations significantly above groundwater background concentrations (USEPA 1999). In wastewater, the incremental increase of calcium ranges from 6 to 16 mg/L (Tchobanoglous, et. al. 1991).
magnesium (Mg): The use of water for domestic purposes increases the concentration of minerals and salts in the effluent. Increases in the groundwater can be used to indicate adverse effects from OWTS. In wastewater, the incremental increase of magnesium ranges from 4 to 10 mg/L (Tchobanoglous, et. al. 1991).
sodium (Na): The use of water for domestic purposes increases the concentration of minerals and salts in the effluent. Sodium increases in the groundwater can be used to indicate adverse

effects from OWTS. In wastewater, the incremental increase of sodium ranges from 40 to 70 mg/L (Tchobanoglous, et. al. 1991). It has been found that sodium is often found in OWTS effluent at concentrations significantly above groundwater background concentrations and may exceed the secondary maximum contaminant level (MCL) (USEPA 1999).

potassium (K): Potassium, like the other cations, is used as a compound to assess the effect of OWTS discharges on the groundwater. Potassium is usually present at levels below 10 mg/L in natural waters (Hem, 1989). In wastewater, the incremental increase of potassium ranges from 7 to 15 mg/L (Tchobanoglous, et. al. 1991). Accordingly, OWTS effluent is often found to contain potassium at concentrations significantly above groundwater background concentrations (USEPA 1999).

iron (Fe): OWTS effluent is known to be capable of creating anoxic conditions in groundwater. Under anoxic conditions, the groundwater oxygen concentration is very low. Microbes in such situations can reduce soil minerals by stripping the oxygen off the molecular compound. Iron is an element that occurs naturally in oxide form and can be reduced to its more water-soluble forms, resulting in increased concentrations in groundwater (McQuillan, et. al. 2004). Relatively small increases in dissolved iron can render the water far less useable, given both the strong smell and taste of iron and the fact that, once it comes out of the tap and the water becomes oxygenated again, the iron will precipitate out, creating stains in sinks and on clothes being washed. It has been found that OWTS effluent may exceed the secondary maximum contaminant level (MCL) for iron, which is 0.3 mg/L (USEPA 1999 and Section 64449, Article 16, Chapter 15, Division 4, Title 22 of the California Code of Regulations). Also, changes in the concentrations of iron in groundwater can provide useful information about the local groundwater REDOX conditions.

manganese (Mn): OWTS effluent is known to be capable of creating anoxic conditions in groundwater. Under anoxic conditions, the groundwater oxygen concentration is very low. Microbes in such situations can reduce soil minerals by stripping the oxygen off the molecular compound. Manganese is an element that occurs naturally in oxide form and can be reduced to its more water-soluble forms that result in increasing its concentrations in groundwater. Manganese, a neurotoxin, is an element that can be found in greater concentrations in groundwater where the aquifer is undergoing anoxic conditions (McQuillan, et. al. 2004). In wastewater, the incremental increase of manganese ranges from 0.2 to 0.4 mg/L (Tchobanoglous, et. al. 1991). Since, the Secondary MCL for manganese is 0.05 mg/L (Section 64449, Article 16, Chapter 15, Division 4, Title 22 of the California Code of Federal Regulations), it has been found that OWTS effluent may exceed the secondary MCL for manganese (USEPA 1999).

zinc (Zn): Elevated zinc concentrations has have been found in OWTS effluent plumes (MPCA 1999). Zinc is associated with the potential increased toxicity of groundwater where the water is used as domestic water or as supporting wildlife or aquatic life (freshwater replenishment) (Canter et. al. 1986).

sulfate (SO_4) OWTS effluent is known to be capable of creating anoxic conditions in groundwater. Sulfate is an anionic compound of Sulfur that occurs naturally in oxide form and can be reduced to hydrogen sulfide, a gas producing undesirable odors in water. Sulfate is often found in OWTS effluent at concentrations significantly above groundwater background concentrations (USEPA 1999).

chloride (Cl): Chloride is a highly mobile salt anion once dissolved in water. Chloride is a useful indicator parameter for OWTS effects because it is a conservative pollutant (not degradable) and is often found in OWTS effluent at concentrations significantly above groundwater background concentrations (USEPA 1999). Chloride-nitrate ratios can be used to differentiate between potential nitrate sources (McQuillan, et. al. 2004).

nitrate (NO_3): Nitrate is a major pollutant discharged from OTWS and is known to cause widespread degradation of groundwater. OWTS effluent has been found to exceed the drinking water primary maximum contaminant level for nitrate. Excessive nitrate in groundwater is associated with methemoglobenemia (Canter et. al. 1886, p. 58). Chloride-nitrate ratios can be used to differentiate between potential nitrate sources (McQuillan, et. al. 2004).

nitrite (NO_2): Nitrogen comes in many forms and is one of the greatest pollutants of concern associated with OWTS. The nitrogen forms of concern are primarily the anionic forms resulting from waste degradation. Nitrite is a product of waste degradation and a precursor to nitrate (Canter et. al. 1886, p. 77).

fluoride (F): OWTS effluent can potentially increase the groundwater concentration of pollutants. As a chemical that is not reduced in the environment, fluoride is a chemical pollutant that can be used as an indicator of OWTS effects on groundwater. In wastewater the incremental increase of fluoride ranges from 0.2 to 0.4 mg/L (Tchobanoglous, et. al. 1991).

total dissolved solids (TDS): TDS can be used as an aggregate indicator for evaluating OWTS effects on groundwater. In wastewater, the incremental increase of TDS ranges from 150 to 380 mg/L (Tchobanoglous, et. al. 1991).

total alkalinity: Total alkalinity can be used as an aggregate indicator for evaluating OWTS effects on groundwater. In wastewater, the incremental increase of total alkalinity ranges from 60 to 120 mg/L (Tchobanoglous, et. al. 1991).

carbonate (CO_3): Carbonate can be used as an aggregate indicator for evaluating OWTS effects on groundwater. In wastewater, the incremental increase of carbonate can be up to 10 mg/L (Tchobanoglous, et. al. 1991).

bicarbonate (HCO_3): Bicarbonate can be used as an aggregate indicator for evaluating OWTS effects on groundwater. In wastewater, the incremental increase of bicarbonate ranges from 50 to 100 mg/L (Tchobanoglous, et. al. 1991).

MBAS: Methylene-Blue Active Substances (MBAS) are pollutants associated with detergents and, when found in groundwater samples, indicate that the groundwater below the site is affected by human activities including OWTS discharges.

hydrogen ion concentration (pH): pH is a measure of the hydrogen ion concentration. The hydrogen ion concentration has a strong influence on whether a virus is retained in the soil environment or whether it moves with groundwater (Canter 1986).

total coliforms: The presence of coliform bacteria in groundwater indicates potential pollution from human sources, like OWTS discharges.

Escherichia coli: The presence of Escherichia coli bacteria further indicates pollution from human sources to groundwater.

§30002(u) — Septic tanks are designed to accumulate solids. Eventually, they require pumping to restore room for solids accumulation. The septic tank should be pumped before solids in the septic tank begin affecting its function. The necessary frequency for pumping a septic tank varies with the number of people using the system, the size of the tank, and the actual use. However, it is found that pumping intervals, using a 95 percent confidence interval, can be expected as frequently as once every four years to once every 25 years (Bounds 1994). As such, a solids inspection once every 5 years by a professional who understands septic tank performance represents a reasonable minimum inspection frequency.

§30002(v) — The discharge of water softener backwash water can result in increases of total dissolved solids (cationic and anionic salts) in groundwater. Pollution of groundwater by brine coming from septic tanks has been documented (Perkins1989). The salts in the regenerating saline backwash, primarily chlorides, are soluble and not removed in the OWTS. Therefore, these proposed regulations recommend against this discharge to the OWTS or the land surface.

§30002(w) — Malfunctioning OWTS pose a threat to human health and the environment. For that reason, expedient corrective actions of OWTS must be performed where needed. However, timely corrective actions for long-lasting repairs depend both on the availability of a contractor to perform the work and conducive environmental conditions (e.g. soil conditions that are not too wet, no site access constraints). The SWRCB expects that, in most cases, 90 days is sufficient to perform the corrective action, but as many as 180 days may be necessary in some cases, due to environmental conditions.

--------<>--------

Article 2 GROUNDWATER LEVEL DETERMINATIONS

Including:

§ 30012 SWRCB – Groundwater Level Monitoring

SPECIFIC PURPOSE

The specific purpose of this article is to establish methods to determine seasonal high groundwater levels at the site of a prospective OWTS dispersal field.

FACTUAL BASIS

Due to the significant variability in rainfall throughout the State and the limitations and subjectivity of the soil mottling testing procedure at some locations in the State, it is incumbent upon the applicant to select between the two options to determine the actual height of groundwater, when less than ten feet from the ground surface. The most appropriate method of determining the actual seasonal high groundwater level, for a given parcel in question, is through observation of the soil for mottling as evidence of historic high water levels or actual groundwater monitoring. It is necessary and appropriate for the regulations to recognize these two methods as superior to less effective methods, but to leave the choice of which method to use to the discretion of the professional conducting the site analysis.

§30012 SWRCB -- Groundwater Level Monitoring.

§30012(a) Seasonal high groundwater, when in close proximity to the dispersal field, can result in inadequate treatment of wastewater (USEPA 2002). Seasonal high groundwater must be determined during a site investigation by a qualified professional trained to recognize the presence of subsurface water. A qualified professional is required because site investigations may occur at times when the water may not be present (seasonally). The ten-foot requirement is based on professional judgment and is a reasonable depth, since it has been found that groundwater levels can fluctuate by as much as 15 feet (Laak 1986). Use of other, experiencedbased, information is also an acceptable method to estimate the location of seasonally high groundwater.

§30012(b) The draft regulations rely on soil mottling observations to determine seasonal groundwater levels because these soil conditions can provide a reliable indication during the dry season of what the maximum groundwater elevation is during the wet season, when the groundwater rises as a result of local recharging from infiltration of precipitation. In some cases, groundwater monitoring is required because not all soil exhibits mottling when saturated (USEPA 1980).

§30012(b)(1) Groundwater that will affect the OWTS is the only groundwater of interest. As such, groundwater beneath an impermeable layer does not require monitoring, since it is not expected to interfere with the OWTS operation (USEPA 1980).

§30012(b)(2) This provision is included to allow regulatory discretion for evaluating groundwater and groundwater mounding. OWTS that have flow rates higher than that of a single-family home are more likely to cause groundwater mounding (rise in groundwater levels) and therefore more likely to provide less treatment due to saturated conditions under the dispersal field (USEPA 2002).

§30012(b)(3) Substantial groundwater elevation fluctuations due to recharge by rainfall are common in some areas of California (County of Santa Cruz 1989). Because of these fluctuations with rainfall, the proposed regulations require that measurements be made for an entire wet season to determine seasonal high groundwater. Historically, the highest groundwater elevations have been achieved during the wet season.

§30012(b)(4) Since other hydrologic factors can and do have an impact on seasonal groundwater levels, areas subject to special circumstances such as snowmelt or irrigation must be addressed site-specifically.

§30012(b)(5) Since California hydrology varies significantly across the State, it is appropriate to explicitly allow the Regional Water Boards to develop other groundwater monitoring protocols specific to their region through the basin planning process.

Article 3 PERFORMANCE REQUIREMENTS AND SPECIFICATIONS

Including:

> **§ 30013 SWRCB -- Performance Requirements for Supplemental Treatment Components**
> **§30014. SWRCB -- Dispersal Systems**

<u>SPECIFIC PURPOSE</u>

The specific purpose of this article is to establish environmentally protective, attainable standards of performance for OWTS of all types.

FACTUAL BASIS

Under existing practices, OWTS design, installation, operation, and maintenance activities are carried out in an independent and varied manner. However, OWTS may work poorly or fail if the waste type is not adequately characterized, if the design does not compensate for adverse site-specific conditions, if the design is poorly suited for the site, or if the OWTS is poorly operated and maintained. Requirements in this Article are intended to promote good practice in design, installation, operation, and maintenance statewide.

To further ensure effective use of OWTS, these proposed regulations propose minimum standards for dispersal fields and supplemental treatment systems. The SWRCB recognizes that some local conditions exist where the use of conventional OWTS can be allowed because pathogen reduction is expected at the site, although some degradation of surface water or groundwater from other pollutants may occur. As such, minimum standards that allow for those situations are included in these proposed regulations. However, where acceptable conditions for a conventional OWTS do not exist, an OWTS with supplemental treatment may allow adequate treatment of wastewater. This is acceptable because, by providing a higher level of treatment, OWTS with supplemental treatment do not require as much soil as conventional OWTS to perform an equivalent or greater level of treatment (Duncan et. al. 1994).

The proposed regulations state that OWTS with a supplemental treatment system shall be designed to ensure at least two feet of unsaturated soil below the bottom of the dispersal system and above impermeable strata and fractured/weathered bedrock at all times. In fact, many supplemental systems are designed specifically for such site limitations. Therefore, the SWRCB, with this regulatory scheme, is allowing all types of OWTS, so long as they function in a manner that minimizes groundwater or surface water pollution. To achieve this goal, the SWRCB proposes the following new regulatory scheme:

- **Independent Third Party Certification —** Proprietary equipment that serves as a component of an OWTS must be certified as capably and reliably meeting the listed performance standards so that there is reasonable degree of confidence that those OWTS will operate to minimize water quality degradation and protect public health for a reasonable duration;

- **Monitoring —** All OWTS with a supplemental treatment system are required to have telemetry monitoring and alarms to indicate system failure. All OWTS with pumps are required to have alarms in the case of failures. These monitoring and alarm systems are intended to assist in ensuring that OWTS operate in a manner intended, thus minimizing any impact on the environment and human health.

- **Long-term Application Rates —** All new OWTS are required to be designed based on an estimated long-term application rate established for the protection of water quality and long OWTS service life. In addition, this approach is needed to ensure that the homeowner's investment (in the OWTS) continues to result in reliable performance.

As written, the SWRCB's proposed OWTS regulatory scheme does not reject any existing or future design aspect or component. Rather, it allows the use of innovative approaches to wastewater treatment provided that those OWTS are properly designed or evaluated and approved by a third party, in addition to including, where necessary, backup features to ensure proper management. This constitutes a reasonable approach to ensure that OWTS prevent gross introductions of pollutants and/or pathogens into California's valuable surface water and groundwater bodies.

§30013 SWRCB—Requirements for Supplemental Treatment Components

§30013(a) — This paragraph is intended to clarify what site constraints would allow or restrict the use of conventional OWTS and OWTS with supplemental treatment components.

§30013(b) — This provision prescribes performance standards for conventional pollutants [biochemical oxygen demand (BOD) and total suspended solids (TSS)] in order to ensure that the supplemental treatment component is performing as intended. These treatment standards are required as part of the independent third party testing to ensure that certified supplemental OWTS are a valid technology that can properly operate consistently for a minimum period of time. The proposed treatment standards for BOD and TSS are readily achievable for all properly functioning supplemental treatment components designed to treat the organic wastewater load and are included as part of existing third party certification requirements (SWRCB 2002, NSF 2000).

§30013(c)(1) and (2) — Disinfection is required where there are pathogen pollution problems [§30040(a)(2)] and where the soil is thin and may not be capable of full pathogen treatment [§30014(i)]. Disinfection systems, if adequately maintained, can operate to achieve full disinfection (Arizona 2005). In cases where the OWTS must provide supplemental treatment to remove pathogens, the proposed regulations contain two performance requirements for different types of soil textures. The two different levels of disinfection proposed here are established for the protection of groundwater quality.

Highly permeable soils (course sands), areas with very thin soils, or soils with a high percentage of rock fragments may not provide the level of treatment necessary to effectively remove pathogens before entering groundwater (Canter et. al. 1986). For these soil types, the proposed regulations contain a limit of 10 MPN/100 ml. This is very close to maximum disinfection achievable and leaves a very small population of viable microorganisms for the soil environment to remove in order to limit or exclude pathogens from entering groundwater. This level of disinfection may require additional contact time with the disinfection process (USEPA 2002).

The second disinfection performance requirement is for sites with soils that can be expected to provide reasonable treatment for pathogens (soils that consist with more fines mixed with sand). For these sites, the performance requirement of 1000 MPN/100 ml is proposed. This second standard is readily achievable (USEPA 2002).

30013(d) — Upon discharging to groundwater in a water table environment, contaminant plumes from OWTS tend to be long, narrow, and definable, exhibiting little dispersion (USEPA 2002). If the OWTS discharge is to a fractured rock environment, the discharge may travel considerable distances unpredictably with little or no dilution (Winneberger 1984). For this reason, nitrogen pollution from OWTS is a concern.

For OWTS sites where nitrogen is shown to be, or threatens to be a pollution problem, the SWRCB is proposing a performance standard as an effluent limit for total nitrogen. The performance standard for total nitrogen is based upon California's drinking water standard (Section 64431(a), Article 4, Chapter 15, Title 22 of the California Code of Regulations) for nitrate. Unless removed, the majority of the nitrogen compounds will be transformed into nitrate in the soil and eventually enter the groundwater (Miller and Wolf 1977). Achieving the proposed performance standard for nitrogen has shown to be achievable by several technologies (SWRCB 2002).

30013(e) —The proposed regulations require that all supplemental treatment components used in OWTS function as intended. To this end, all OWTS using supplemental treatment components are required to be designed by a qualified professional, as is required for a conventional OWTS. Even with such requirements, more skepticism confronts the use of proprietary technology. This is, in part, due to documentation of proprietary technology used as OWTS that either performed poorly or not at all (Pearson 1977). For that reason, third party verification of proprietary technology is proposed in the regulations.

The independent third party certification protocol required by the proposed regulations is closely matched to the existing process used by the National Sanitation Foundation (NSF) International: Residential Wastewater Treatment Systems NSF/ANSI 40 (Standard 40). This was chosen because NSF International is widely recognized (Pearson 1977), has over 30 years of experience, and NSF has certified 315 different OWTS products from over 35 manufacturers (NSF International 2006). Although the protocol in the proposed regulations is based upon the NSF Program, any other independent third party that meets or exceeds the protocol standard will qualify for use under this rule.

30013(e)(1) —This testing provision requires the system to run for a sufficient period of time for the evaluation process to be completed, using a variety of use conditions to validate the system's long-term performance capabilities, just as such a test would be carried out by the NSF (NSF International 2006).

30013(e)(2) — As with any evaluation, there should be a minimum amount of data showing actual performance of the OWTS. The number of sampling days is the minimum required for the NSF Certification.

30013(e)(3) — This provision requires that the evaluation of samples be performed in a manner that produces reliable data. Certified laboratories are the best group to provide analyses of samples.

30013(e)(4) — These regulations apply to OWTS accepting domestic-strength wastewater. Therefore, wastewater used for evaluating these OWTS must fall within the range of domestic waste for the pollutant parameters of concern, the same as would be done in a test carried out by the NSF (NSF International 2006).

30013(e)(5) — OWTS treat a variable wastewater flow at homes and businesses including regular daily use and vacation use (rest). The NSF standard uses similar wastewater flow simulations to test the performance of the supplemental treatment systems. The proposed regulation require the minimum level of performance-based testing to validate whether a system can be expected to operate properly or fail (NSF International 2006).

30013(e)(6) —These detection limits are required to ensure that all testing will be performed in a manner that results in usable and reliable data. Also, these limits are being required so that the evaluation of the effluent data is comparable to other data from other OWTS and useful for overall program assessment.

30013(f) — OWTS with supplemental treatment systems are allowed in more sensitive areas on the basis that those systems operate in a manner that provide greater protection of human health and the environment. Since most supplemental treatment systems rely on mechanical components (typically pumps) for operation, they are more subject to failure than passive systems and have demonstrated high failure rates in some evaluations (Sexstone et. al. 2000). Accordingly, it is imperative that those systems operate as designed and be quickly repaired when not operating properly. For this reason, monitoring is an important component for any program (USEPA 2002, Eliasson et. al. 2001), especially monitoring in a manner consistent with the operation and maintenance manual.

30013(g) —Monitoring the operation and performance is necessary for any successful OWTS program (SWRCB 2002). A malfunctioning supplemental treatment system can pollute surface water and groundwater if left unattended. For this reason, the proposed regulations require that all OWTS with supplemental treatment components have alarms (e.g. audible, visual and telemetric) that indicate failure of the OWTS at the site and propose, sending alarm reports through telephone lines. Traditional alarms and telemetric technology are available and affordable for use (SWRCB 2002, NSF undated, Tsukuda 2004). For OWTS with mechanical components, a one-day flow (24-hr) of storage capacity is found to be a good practice (NSFC undated) and to minimize wastewater surface overflows.

30013(h) — Disinfection is required where pathogen contamination already exists [§30040(a)(2)] or where the soil is thin [§30014(i)] and unlikely to be capable of adequate pathogen removal. Where such treatment is required, a malfunctioning supplemental treatment system can contaminate surface water and groundwater if left unattended. Contamination in such cases is unacceptable. Unfortunately, disinfection processes have been shown to be subject to more frequent problems than other types of supplemental treatment (SWRCB 2006, Sexstone et. al. 2001). For this reason, the proposed regulations require that all OWTS with supplemental treatment for disinfection have a monitoring system that ensures that the disinfection unit is operating properly either through continual monitoring, or, otherwise, through frequent inspections. Telemetry is available and affordable for OWTS, and is capable of assessing the operation processes (Jesperson 2000).

The minimum detection limit is established to ensure that total coliform testing will be performed in a manner that results in usable data. Also, this is being prescribed so that the evaluation of the effluent data for total coliforms can be conducted in a manner that ensures the data of the OWTS is comparable to similar data from other OWTS and useful for overall program assessment.

§30014. —SWRCB —Dispersal Systems.

§30014(a)—The most biologically active area in a soil column is the aerobic environment at or near the ground surface. An aerobic environment is desired for most wastewater treatment and dispersal systems. Aerobic decomposition of wastewater solids is significantly faster and more complete than anaerobic decomposition. Also, "maximum delivery of oxygen to the infiltration zone is most likely when soil components are shallow and narrow and have separated infiltration areas" (USEPA 2002). Another reference (Canter 1986, p. 61) states: "Greater biological activity can be anticipated in the upper layers of soil underneath the soil absorption system." In addition to atmospheric oxygen availability, the USEPA's publication Design Manual, Onsite Wastewater

Treatment and Disposal Systems (USEPA 1980) states that: "Shallow trenches often are best because the upper soil horizons are usually more permeable and greater evapotranspiration can occur." This general requirement is important to include because the purpose of this rulemaking is the proper treatment of OWTS wastewater. In some cases, OWTS dispersal systems are placed unnecessarily deep, and therefore, not designed to provide the best treatment of the wastewater.

§30014(b) —Both the bottom and sidewall areas of the dispersal system excavation can be infiltration surfaces; however, in order to allow the sidewall to be an infiltrative surface, the bottom surface must pond. If continuous ponding of the infiltration surface persists, the bottom infiltration zone will become anaerobic, resulting in a significant loss of hydraulic capacity of the bottom area for dispersal and less complete decomposition of the wastewater. Loss of the bottom surface for infiltration will cause the ponding depth to increase over time as the sidewall also clogs. If allowed to continue, premature hydraulic failure of the system is possible. Therefore, including sidewall area as an active infiltration surface in design should be avoided (USEPA 2002). The application rates in Table 2 and Figure 1 are based on the North Coast Region Basin Plan and are established for unsaturated treatment of the wastewater in the subsurface soils (North Coast Regional Water Board 2005). These application rates were chosen during the Stakeholder meetings and found to be acceptable in peer review.

§30014(c) — Although Appendix K of the California Plumbing Code (CPC 2000) already requires at least a five foot separation from the water table statewide, such minimum separation is not required for one- and two-family dwellings or where alternate facilities or installations have been approved by local government. This creates no single minimum standard. Accordingly, the proposed regulations require at least three feet of unsaturated soil beneath the dispersal system because research has shown that between two and three feet of unsaturated soil is necessary for the retention of and die-off of pathogens (USEPA 2002). Soil particles, for this purpose, are those with a diameter less than 2mm (USDA 1993). This soil depth establishes a statewide minimum standard for OWTS soil dispersal systems.

§30014(c)(1 & 2) — Soils with a high proportion of coarse fragments (gravel, cobbles and rock) pose a problem for the treatment of the wastewater because the volume occupied by the coarse fragments is not available for providing the treatment of the wastewater (Woessner et. al. 1987, Ver Hey and Woessner 1987). For that reason, it has been suggested that this rock fraction not be credited as a treatment part of the soil column, thus requiring compensation for the rock content (State of Wisconsin 2004). Accordingly, the proposed regulations provide that when the gravimetric fraction of coarse fragments in earthen material is greater than thirty percent, the effective depth of very porous media is effectively reduced by approximately one foot of depth (30% of 3 feet).

If the soil contains 30% or greater coarse fragments, the proposed regulations require that the OWTS design either to compensate for the loss of available soil for effluent treatment using Figure 2 or to reduce the application rate. Figure 2 is a direct 1:1 soil volume replacement graph on a semi-logarithmic scale for easier use. Otherwise, the proposed regulations allow OWTS designers to compensate for the loss of available soil for effluent treatment by reducing the application rate proportionally to the percent rock in the earthen material. This is an important provision for sites that have limited soil depth but that have enough area to spread the effluent through an enlarged dispersal field. For either method, the compensation for the treatment volume lost is a straight percentage calculation (based on a gravimetric analysis of the earthen material). Pressure distribution is required to assure even distribution of the effluent across the entire OWTS dispersal field, since gravity dispersal has been found to be ineffective in rocky soils (Ver Hey 1987, Laak 1986). These requirements are reasonable to include in this rulemaking because they are necessary to ensure that proper treatment and disposal of wastewater occurs during the use of OWTS.

§30014(d) — Although Appendix K of the California Plumbing Code (CPC 2000) already requires at least a five foot separation from the water table statewide, such minimum separation is not required for one- and two-family dwellings or where alternate facilities or installations have been approved by local government. This creates no single minimum standard for one of the major components for most OWTS. Accordingly, the proposed regulations require two feet of soil below the bottom of the soil dispersal systems for OWTS with supplemental treatment. This provision establishes a statewide minimum standard and is required because it is found that between two and three feet of unsaturated soil is necessary for the retention of and die-off of pathogens (USEPA 2002) and that effluent treatment can be substituted for soil depth (Duncan et. al 1994). Soil particles are those with a diameter less than 2mm (USDA 1993).

§30014(d)(1 & 2) — Soils with a high fraction of coarse fragments (gravel, cobbles and rock) pose a problem for the treatment of the wastewater because the volume occupied by the coarse fragments is not available for providing the treatment of the wastewater (Woessner et. al. 1987, Ver Hey and Woessner 1987). For that reason, it has been suggested that this rock fraction not be credited as part of the soil column, thus requiring compensation for the rock content (State of Wisconsin 2004).

As with the requirement above for conventional OWTS, in cases where supplemental treatment is used, the proposed regulations require compensation for loss of soil where the earthen material consists of more than 30 percent rock by using Figure 2 or by increasing the soil application area proportionally. Thirty percent was determined using the same rationale discussed above for §30014(c)(1&2). Figure 2 is a direct 1:1 soil volume replacement graph on a semi-log scale that increases earthen material depth. Otherwise, the proposed regulations allow OWTS designers to compensate for the loss of available soil for effluent treatment by reducing the application rate proportionally to the percent rock in the earthen material. This is an important provision for sites that have limited soil depth but that have enough area to spread the effluent through an enlarged dispersal field. For either method, the compensation for the treatment volume lost is a straight percentage calculation (based on a gravimetric analysis). Pressure distribution is required to ensure effluent dispersal across the entire OWTS dispersal system, since gravity dispersal has been found to be ineffective in rocky soils (Ver Hey and Woessner 1987, Laak 1986). These requirements are reasonable to include in this rulemaking because they are necessary to ensure that proper treatment and disposal of wastewater occurs during the use of OWTS.

§30014(e) — This provision allows the use of fill to make up for the lack of adequate soil depth, up to a maximum of one foot. The placement of fill material to serve as treatment media and as a means to increase separation from sensitive receptors has been used in onsite wastewater treatment for several decades. These systems have usually been constructed to overcome site constraints like shallow soils or high groundwater elevations (Goldstein et. al. 1973, Machmeier 1977, Salvato 1977, USEPA 1980). The development of the mound system (a.k.a. Wisconsin Mound) is an example of the use of fill, although the mound is excluded from this provision so that nothing in this provision restricts the design of mound systems, which have had considerable design review and research. In fact, Table 2 is a specification derived from Wisconsin mound sand (Converse et. al. 2000). This is because soils considered effective for this application are coarse, non-cohesive, single-grained materials like sand so that compaction and the creation of impermeable lenses is minimized (Engle et. al. 1982, Converse 2000). Because of the nature of the fill and concern for rapid permeability of the material (uniform, single grain material), the proposed regulations require a 1.5 to 1 replacement of fill to native soil as a factor of safety. For example, a conventional OWTS and an OWTS using supplemental treatment with one foot of soil equivalent (fill) will have a minimum separation to seasonal high groundwater of three feet six inches (3'6") and two feet six inches (2'6"), respectively. The fifty percent increase in fill over native soil is required as a factor of safety, to ensure that these systems have sufficient soil to provide unsaturated retention time. This factor of safety is reasonable since sand is a granular soil texture that usually contains no structure and therefore primarily relies on space between the soil particles, usually resulting in rapid permeability (USEPA 1980, 2002).

§30014(f)—If a pump fails, the OWTS fails and pollution may result. Therefore, the proposed regulations require an alarm system be installed for all OWTS with pumps. The alarm may be audible, visual or telemetric (USEPA 1980, USEPA 2002). For OWTS with pumps, a one-day (24-hours) of storage capacity is found to be good practice to minimize wastewater surface overflow (NSFC undated).

§30014(g) With more uniform distribution of the wastewater, there is a tendency to raise these systems closer to the land surface (Beggs, et. al. 2004). However, it is also important to keep a barrier between humans and the OWTS effluent. For this reason, the proposed regulations specify this minimum depth of cover soil. This is supported in literature (Crites 1998).

§30014(h) Driving vehicles across the dispersal system is bad practice due to concerns regarding compaction of the soil, breaking OWTS dispersal system pipes, or causing other damage.

§30014(i) It has been shown in the laboratory and in the field that gravel-less chambers function as well as conventional dispersal systems even when the system size is reduced by as much as fifty percent (King, et. al. 2002). When gravel-less chambers are sized equivalently to conventional OWTS, it has been shown that the long-term acceptance rate can be 1.5 to 2 times higher than that of conventional OWTS dispersal systems (Seigrist et. al. 2004). For this reason, the proposed regulations include a multiplier allowing the reduction of the dispersal system when chambers are used. Although Appendix K of the California Plumbing Code (CPC 2000) already includes this requirement, compliance with Appendix K is not required for one- and two-family dwellings or where alternate facilities or installations have been approved by local government. This creates no single minimum standard for one of the major components for most OWTS. Accordingly, the proposed regulations will establish a baseline uniform standard.

§30014(j)(1) —Drip dispersal and pressure dispersal systems are used to distribute wastewater across the dispersal field in a manner that is more uniform than gravity dispersal systems (USEPA 2002). Drip dispersal systems may pose less of a threat to the environment than a conventional dispersal field because of the design, how the wastewater is applied and the fact that dispersal to the soil surface improves system treatment performance by increasing aeration. However, the design area should not be over-credited for applying effluent.

§30014(j)(2) — Due to the fact that the orifices and emitters are small, these types of dispersal systems are susceptible to clogging. Accordingly, these systems need to be designed with a means to assist the owner in keeping them clean. Several methods can be used to avoid orifice plugging (e.g. filters, biocide impregnated components) (EPRI 2004).

§30014(k), §30014(k)(1)— Seepage pits are deep excavations used for subsurface dispersal of pretreated wastewater. Historically, seepage pits have been used where land area is too limited for a leachfield or bed or where the upper 3 to 4 feet of soil is poor for OWTS and underlain by a more permeable soil (USEPA 1980). Seepage pits primarily rely on, and are accordingly designed for, using the sidewall as the infiltrative surface (Kaplan 1987, p. 110). This provision is consistent with those existing standards. Seepage pits, as a result of their depth and relatively small plan view (horizontal) profile and depth, are believed to be a greater threat as a pollution source than other types of dispersal systems. In fact, the use of seepage pits is no longer commonly accepted by experts in the field as a "best management practice" (USEPA 1999). Therefore, the proposed regulations allow seepage pits only if the site is unsuitable for other types of dispersal systems (USEPA 2002).

§30014(k)(2) — The proposed regulations require a separation from groundwater of at least 10 feet at all times for seepage pits. Although Appendix K of the California Plumbing Code (CPC 2000) already requires at least ten feet of separation from the water table statewide, it is not required for one- and two-family dwellings or where alternate facilities or installations have been approved by local government. This results no single minimum standard for one of the major components for most OWTS.

§30014(k)(3)(A)— Soil available to provide the soil treatment of OWTS effluent is a determining factor to treatment requirement for all OWTS using seepage pits, just as with other dispersal systems that use the soil as the final treatment media. Where soil between the bottom of the seepage pit and the groundwater is ten feet, it is believed that there is enough soil to provide treatment of conventional OWTS (CPC 2000).

30014(k)(3)(B)— Soil available for providing the soil treatment of OWTS effluent is a determining factor for all OWTS using seepage pits, as with other dispersal systems that use the soil as the final treatment media. Where soil thickness between the bottom of the seepage pit and rock is less than ten feet but greater than two feet, the OWTS must meet performance standards contained in §30013(a) for conventional pollutants and must meet the disinfection requirements contained in §30013(b) before discharging into the seepage pit. The intent of this requirement is to provide active treatment before discharging to the seepage pit to compensate for the lack of soil treatment. This is proposed because, by providing a higher level of treatment, supplemental systems do not require as much soil as standard septic systems to perform an equivalent or greater level of treatment (Duncan et. al. 1994).

30014(k)(3)(C) — Similar to the issue discussed directly above, soil available to provide the soil treatment of OWTS effluent is a determining factor for all OWTS using seepage pits. The unsaturated flow of wastewater through the soil is expected to provide treatment of the wastewater. Where soil thickness between the bottom of the seepage pit and rock is less than two feet, there is a lack of soil available for providing treatment and it requires the OWTS to provide additional treatment as mitigation. For this reason, the proposed regulations require that the OWTS must meet performance standards contained in §30013(a) for conventional pollutants and must meet the disinfection requirements contained in §30013(b) (1) before discharging into the seepage pit. The intent of this requirement is to provide active treatment and reduce pathogen indicators to very low levels before discharging to compensate for the lack of soil treatment. This is proposed because, by providing a higher level of treatment, supplemental systems do not require as much soil as standard septic systems to perform an equivalent or greater level of treatment (Duncan et. al. 1994).

§30014(l) — The purpose of these requirements is to ensure that the designer of the evapotranspiration and infiltration system considers the full hydrologic cycle so as to minimize insufficient designs leading to overflow. An OWTS using an ETI system must be capable of disposing of precipitation falling on and being captured by the ETI system. SWRCB guidance (SWRCB 1980) recommends that the design assume that 100 percent of all the rainfall on the bed enters the OWTS. To clarify whether this is the 100-year probability event, average rainfall or some other level of rainfall event, the 25-year return frequency was selected because it is considered the probable design life for the OWTS.

--------<>--------

Article 4 Protecting Waters Listed Pursuant to CWA Section 303(d)

Including:

§30040. Provisions for Protecting Impaired Waters.

<u>SPECIFIC PURPOSE</u>

The specific purpose of this article is to fulfill statutory requirements and apply water quality protection standards for new and existing OWTS adjacent to waters listed as impaired pursuant to the Section 303(d) of the Clean Water Act where OWTS have been determined to be contributing to the impairment.

<u>FACTUAL BASIS</u>

Where OWTS have been identified as contributing to the impairment of a surface water body, it is appropriate to impose performance requirements on all such OWTS at the earliest practical time, both for new and existing OWTS. Therefore, these proposed regulations apply to new and existing OWTS. Since it is easier to install new OWTS with supplemental treatment components than to retrofit an existing OWTS with supplemental treatment, these regulations impose a compliance date that is earlier for new OWTS than existing OWTS.

The determination for designating which OWTS are adjacent and likely to be contributing is difficult to accomplish due to site-specific conditions. For this reason, the proposed regulations allow two methodologies to determine which OWTS are adjacent and contributing to impairment of the surface water body. The proposed regulations use a general capture distance (600 feet) in lieu of requiring a case-by-case determination from the edge of the river bank, lake or the mean high tide to designate OWTS presumed to be a threat to surface water. This capture distance is the same as that used in the Drinking Water Source Assessment and Protection Program by the Department of Public Health (CA DHS 1999). As detailed in the document (page 54), a radial distance establishes a microbial/direct chemical contamination zone to protect public drinking water supply wells from possible contaminating activities associated with viral, microbial and direct chemical contamination. OWTS are identified as possible contaminating activities posing "very high potential risks" . For porous media aquifers, 600 feet was the recommended minimum distance to be sufficiently conservative for protection from possible contaminating activities associated with viral, microbial and direct chemical (CA DHS 1999).

Otherwise, the proposed regulations also allow a case-by-case determination for OWTS in proximity of impaired waters.

§30040 Introductory ¶ — This paragraph provides the scope for the section's applicability. This helps eliminate the need to include a description of that scope in each paragraph of the section.

§30040(a) — This paragraph serves to narrow the scope of the underlying subparagraphs to situations where OWTS may impair surface water bodies due to the release of nutrients ¶(a)(1) or pathogens ¶(a)(2). In this section, these regulations define OWTS as "adjacent" to impaired waters if they are within 600 feet of the waterbody. This determination is based on the Department of Health Service's Drinking Water Source Assessment and Protection Program (DWSAP) (DHS 1999). In that program, OWTS are identified as a possible contaminating activity with very high potential risks for community water supply wells. The proposed regulations take this approach because site specific determinations, although allowed, can be expensive and a surface or subsurface failure of an OWTS has a high probability of reaching surface waters if such OWTS are only 600 feet away, as opposed to all OWTS in the watershed. However, the proposed regulations also allow a more accurate site-specific analysis determination for the purposes of identifying and excluding OWTS that are determined not to contribute pollutants to an impaired water body.

§30040(a)(1) — This section of the regulations requires the removal of conventional pollutants (BOD and TSS) as well as total nitrogen, which is the chemical pollutant of concern. Conventional pollutants are required to be removed because all OWTS that remove nitrogen also remove conventional pollutants to the performance standards when properly operating. By removing the pollutant of concern and requiring operation and maintenance, the pollution source associated with OWTS should also be abated.

§30040(a)(2) — This section of the regulations requires the removal of conventional pollutants (BOD and TSS) as well as pathogens, which is the biological pollutant of concern. Conventional pollutants are required to be removed because all disinfection systems perform more reliably when conventional pollutants are removed. By removing the pollutant of concern and requiring operation and maintenance, the pollution source associated with OWTS should also be abated.

§30040(b) — This portion of the draft regulations addresses water bodies that may be deemed impaired in the future by providing the same reasonable timeframes to perform active treatment. The proposed regulations require the owners to determine whether the discharge from their existing OWTS is reaching groundwater and causing pollution. Such determinations must be made during the period of one year after the effective date of the regulations. This one-year timeframe is appropriate given the gravity of the situation but also allows time for the OWTS owners to understand the requirement and to schedule and have the inspection conducted by a qualified professional. The report is required within 30 days after the inspection because this is a reasonable period of time to complete and submit the report to the Regional Water Board. In the absence of an inspection and determination, the OWTS must comply with the requirements in Section 30040(a).

Where existing OWTS are likely to be contributing pollutants to the water body, the prescribed corrective action is neither inexpensive nor always easily designed. Accordingly, four years to plan and execute the remedy is reasonable given the task required.

§30040(c) — This portion of the draft regulations allows modifications of the 600-foot distance based on site-specific information through the TMDL process. This is reasonable because site-specific information makes such determinations more accurate. This process would still comply with the allotment of time required for all other impaired water bodies.

§30040(d) — This portion of the draft regulations allows owners of OWTS within 600-feet of an impaired water body to be exempt from this section of the regulations where the water quality problem is being solved under the TMDL regulatory process that includes necessary components for resolving pollution problems. This is reasonable because additional regulations addressing a problem already subject to an existing regulatory process is duplicative.

§30040(e) — This provision of the proposed regulations allows OWTS owners to avoid upgrading and installing supplemental treatment systems if they have agreed to remove the discharge through connection to a sewage treatment plant. This is reasonable since the discharge would be removed from the area's hydrology and thus no longer contributes to impairment of the water body. Such owners would be provided the same period of time for coming into compliance as for owners to upgrade their existing OWTS.

REFERENCED DOCUMENTS

1. Arizona Department of Environmental Quality (**AZDEQ**), **The Impacts of Septic Systems on Water Quality of Shallow Perched Aquifers: A Case Study of Fort Valley, Arizona**, February 1997, 8 pp.
2. State of Arizona, **Notice of Proposed Rulemaking, Chapter 9, Title 18, Arizona Administrative Register, Vol. II, Issue 2**; Arizona Secretary of State, January 2005.
3. Ball, H.L., **Nitrogen Reduction in an Onsite Trickling Filter/Upflow Wastewater Treatment System**, Proceedings from the Seventh National Symposium on Individual and Small Community Sewage Systems; ASAE, 1994, pp. 499.
4. Bauman, B.J. and Schafer, **W.M., Estimating Ground-Water Quality Impacts from Onsite Sewage Treatment Systems**, Proceedings from the Fourth National Symposium on Individual and Small Community Sewage Systems; ASAE, 1985, pp. 285.
5. Beggs, R. A., Tchobanoglous, G., Hills, D. and Crites, R. W., **Modeling Subsurface Drip Application of Onsite Wastewater Treatment System Effluent,** Proceedings from the Tenth National Symposium on Individual and Small Community Sewage Systems; ASAE, 2004, pp. 92.
6. Bicki, T.J., and Lang, J. M., **Fate of Pesticides Introduced Into On-Site Sewage Disposal Systems;** Proceedings from the Sixth National Symposium on Individual and Small Community Sewage Systems; ASAE, 1991, pp. 86.
7. Bounds, T.R., **Septic Tank Septage Pumping Intervals,** Proceedings from the Seventh National Symposium on Individual and Small Community Sewage Systems; ASAE, 1994, pp. 58.
8. Buchholz, G.M., **An Overview of Alternative Onsite Wastewater Technology**, Individual Onsite Wastewater Systems: Proceedings from the Sixth National Conference, Ann Arbor Science, 1980, pp 81
9. Byers, M. E., Zoeller, K. E. and Fletcher, J. D., **Septic Tank Effluent Filter: Monitoring and Assessment**; Proceedings from the Tenth National Symposium on Individual and Small Community Sewage Systems; ASAE, 2004, pp. 284
10. California Department of Health Services (CA DHS), **Drinking Water Source Assessment and Protection (DWSAP) Program**, Division of Drinking Water and Environmental Management, CA DHS, January 1999.
11. Appendix K, 2002 California Plumbing Code
12. California Department of Water Resources, **Water Well Standards: State of California**, Department of Water Resources, P.O. Box 388, 1981
13. California Wastewater Training & Research Center and USEPA Region 9 Ground Water Office (**CWTRC & USEPA-R9**), **Status Report: Onsite Wastewater Systems in California, Final Draft**, August 2003
14. California Wastewater Training & Research Center and State Water Board: **Onsite Wastewater Treatment System Repair of Failure/Malfunction Survey Final Report**, January 2003.
15. Canter, L. W. and Knox, R.C., **Septic Tank System Effects on Ground Water Quality**; Lewis Publishers, Inc., 121 South Main Street, Chelsea, MI 48118, 1986.

16. Carlile, B.L**., Performance Evaluation of Alternative Waste Systems for Lake and Coastal Developments in Texas**, Proceedings from the Seventh National Symposium on Individual and Small Community Sewage Systems; ASAE, 1994, pp. 238.
17. Converse, James C. and Tyler, E. Jerry, **Wisconsin Mound Soil Absorption System: Siting, Design and Construction Manual**, Small Scale Waste Management Project, College of Agricultural and Life Sciences, University of Wisconsin-Madison, 2000.
18. Corr, S. H. and Brown, N., **Field Performance of Innovative/Alternative Treatment Technologies in the Title 5 Program in Massachusetts**, The Northeast Onsite Wastewater Treatment Short Course & Equipment Exhibition Conference Proceedings, March 24-26, 2002
19. Crites, R. and Tchobanoglous, G., **Small and Decentralized Wastewater Management Systems**, WCB/McGraw-Hill, 1998, pp.3
20. Crosby, J.; McCarthy, B.; Gilbertson, C.; Axler, R.; **A Regulatory Perspective on Impediments and Solutions to the Use of Performance Standards for Onsite Wastewater Treatment**,; ASAE, 1998, pp. 259.
21. Driscoll, F.G., **Groundwater and Wells**; Johnson Filtration Systems, St. Paul, MN 1989, pp. 614
22. Duncan, C.S., Reneau Jr., R. B., and Hagedorn, C., **Impact of Effluent Quality and Soil Depth on Renovation of Domestic Wastewater**, Proceedings from the Seventh National Symposium on Individual and Small Community Sewage Systems; ASAE, 1994, pp. 219.
23. Eliasson, J.M.; Lenning, D.A.; Wecker, S.C.; **Critical Point Monitoring – A New Framework for Monitoring Onsite Wastewater Systems**, Proceedings from the Ninth National Symposium on Individual and Small Community Sewage Systems; ASAE, 2001, pp. 461.
24. EPRI, **Wastewater Subsurface Drip Distribution, Peer Reviewed Guidelines for Design, Operation and Maintenance**; EPRI, Palo Alto, CA and Tennessee Valley Authority, Chattanooga, TN.
25. Fetter, C. W., **Applied Hydrogeology**, Macmillan College Publishing Company, Inc. 866 Third Avenue, New York, NY, 1988
26. Geary, P.M. and Whitehead, J.H.; **Groundwater Contamination From Onsite Domestic Wastewater Management Systems in a Coastal Catchment**; Proceedings from the Ninth National Symposium on Individual and Small Community Sewage Systems; ASAE, 2001, pp. 479.
27. Hem, John D., **Study and Interpretation of the Chemical Characteristics of Natural Water**; Paper 2254; USGS United States Government Printing Office, Washington D. C. 20402, 1989 (third printing).
28. Jesperson, Kathy, **Remote Monitoring Use Is on the Rise**; Small Flows Quarterly, Fall 2000, Vol. 1, No. 1, pp. 24, National Small Flows Clearinghouse, West Virginia University, WV 26506-6064.
29. Kaplan, Benjamin O., **Septic Systems Handbook**, Lewis Publishers, Inc., 121 South Main Street, Chelsea MI, 48118, 1987
30. King, Larry D., Hoover, Michael T., Hinson, Thomas H., Polson, Richard L. and Everett, Roger W., **Surface Failure Rates of Chamber and Traditional Aggregate-Laden Trenches in Oregon**, Small Flows Quarterly, Fall 2002, Vol. 3, No. 4, pp. 27, National Small Flows Clearinghouse, West Virginia University, WV 26506-6064.
31. Laak, Rein; **Wastewater Engineeering design for Unsewered Areas – 2nd ed.**; Technomic Publishing Company, Inc. 1986.

32. Loomis, G.; Jobin, L.; Green E.; Herron, E.; Gold, A.; Stolt, M.; and Blazejewski, G.; **Long-Term Treatment Performance of Innovative Systems**, Proceedings from the Tenth National Symposium on Individual and Small Community Sewage Systems; ASAE, 2004, pp. 408.
33. Machmeier, Roger E., **Town and Country Sewage Treatment**, Extension Bulletin 304, Agricultural Extension Service, University of Minnesota, Revised 1977
34. McQuillan, D.; **Ground-Water Quality Impacts from Onsite Septic Systems,** Proceedings, National Onsite Wastewater Recycling Association, 13th Annual Conference, Albuquerque, NM
35. Miller, Fred P. and Wolf, Duanne C.; **Renovation of Sewage Effluents by the Soil,** Proceedings of the Second National Conference on Individual Onsite Wastewater Systems 1975; Nina McClelland ed., 1977, pp. 89; Ann Arbor Science P. O Box 1425 Ann Arbor, MI 48106
36. Minnesota Pollution Control Agency (MPCA); **Effects of Septic Systems on Ground Water Quality – Baxter Minnesota**, Ground Water Monitoring and Assessment Program (GWMAP), 520 Lafayette Road North, St. Paul, MN, 55155, 1999.
37. Mokma, D.L., T.L. Loudon, and P. Miller, **Rationale for Shallow Trenches in Soil Treatment Systems,** Proceedings from the Ninth National Symposium on Individual and Small Community Sewage Systems; ASAE, 2001, pp. 71.
38. Mote, R. and Buchanan, J.R., **System Design for Enhanced Wastewater Renovation in Shallow Soils**, Proceedings from the Seventh National Symposium on Individual and Small Community Sewage Systems; ASAE, 1994, pp. 258.
39. Northcoast Regional Water Quality Control Board, **Water Quality Control Plan for the Northcoast Region**, 2005
40. NSF International, **NSF Onsite Monitoring Program,** NSF International, 789 Dixboro Road, P.O. Box 130140, Ann Arbor, Michigan, 48113, undated
41. NSF International**, Residential Wastewater Treatment Systems: NSF International Standard/American National Standard**; NSF/ANSI 40 – 2000, NSF International, 789 Dixboro Road, P.O. Box 130140, Ann Arbor, Michigan, 48113, 2000
42. NSF International, NSF service Products and Listings, NSF International website: http://www.nsf.org/Certified/Wastewater/Listings.asp?TradeName=&Standard=040; Last Updated May 23, 2006.
43. National Small Flows Clearinghouse (NSFC), **Onsite Wastewater Disposal: Distribution Networks for Subsurface Soil Absorption Systems**, prepared by Richard J. Otis, P.E., Rural Systems Engineering, Wisconsin Madison, NFSC Pub. No. WWBLDM03, undated.
44. Patterson R.A., **Onsite Treatment and Disposal of Septic Tank Effluent**, abstract of PhD thesis, Departments of Resource Engineering and Agronomy and Soil Science, University of New England, Armidale. NSW. 2351 Australia, 1994.
45. Patterson R.A, **Peat Treatment of Septic Tank Effluent**, presented at "Onsite '99. Meeting the Challenge: making onsite wastewater systems work" 13-15th July 1999, at the University of New England, Armidale. NSW. 2351 Australia.
46. Patterson, R.A., Davey, K., and Farman N. **Peat Bed Filters for Onsite Treatment of Septic Tank Effluent**, Conference Onsite '01. Advancing Onsite Wastewater Systems 25-27th September 2001, at the University of New England, Armidale. NSW. 2351 Australia
47. Pearson, Kenneth C.; **Innovation in Wastewater Technology: The Challenge of the 1980's,** Proceedings of the Third National Conference on Individual Onsite Wastewater Systems 1976; Nina McClelland ed., 1977, pp. 301; Ann Arbor Science P. O Box 1425 Ann Arbor, MI 48106

48. Perkins, Richard J.; **Onsite Wastewater Disposal**, pp. 50; Lewis Publishers , Inc., 121 South Main Street, Chelsea, MI 48118
49. Peterson, Thomas C. and Ward, Robert C., **Impact of Adverse Hydrological Events on Bacterial Translocation in Coarse Soils Near Onsite Wastewater Treatment Systems,** Proceedings from the Fourth National Symposium on Individual and Small Community Sewage Systems; ASAE, 1987, pp. 87.
50. Plews, Gary D. and DeWalle, Foppe, **Performance Evaluation of 369 Larger On-Site Systems;** Proceedings from the Fourth National Symposium on Individual and Small Community Sewage Systems; ASAE, 1985, pp. 272.
51. Robertson W.D. and Cherry, J.A., and Sudicky, E.A., **Ground-Water Contamination from Two Small Septic Systems on Sand Aquifers**, Groundwater, January-February 1991, pp. 82.
52. Robertson W.D. and Cherry, J.A., **In Situ Denitrification of Septic-System Nitrate Using Reactive Porous Media Barriers**: Field Trials, Groundwater, January-February 1995, pp. 99.
53. Rogers, Golden, and Halpern, **Development of Nitrate Dilution Model for Land Use Planning in the State of New Jersey, Document #32**, New Jersey Office of State Planning, December 1988, 24 pp [e-file: NJStudy.pdf].
54. Salvato, Joseph, Jr., **Environmental Engineering and Sanitation,** John Wiley and Sons, Inc., New York, 1972, pp. 104.
55. Salvato, Joeseph Jr., **Problems and Solutions of Onlot Sewage Disposal**, Proceedings of the Second National Conference on Individual Onsite Wastewater Systems 1975; Nina McClelland ed.,; Ann Arbor Science P. O Box 1425 Ann Arbor, MI 48106; 1977, pp. 33
56. Santa Cruz County, **Standards and Procedures for the Repair and Upgrade of Septic Systems**, Health Services Agency, County of Santa Cruz, CA March 1999.
57. Sauer, P.A., Tyler, E. J., **VOC and Heavy Metal Treatment and Retention in Wastewater Infiltration Systems Installed in Loamy Sand and Silt Loam Soils,** Proceedings from the Seventh National Symposium on Individual and Small Community Sewage Systems; ASAE, 1994, pp. 173.
58. Sexstone, A., Aiton, M., Bissonennette, G., Fleming, K.; Kinneer, K.; Hench, K., Bozicevich, T.; Cooley, B.; Winant, E.; **A Survey of Home Aerobic Treatment Systems Operating in Six West Virginia Counties**, Small Flows Quarterly, Fall 2000, Vol. 1, No. 1, pp. 38 National Small Flows Clearinghouse, West Virginia University, WV 26506-6064.
59. Siegrist, Robert L., McCray, John E., and Lowe, Kathryn S.; **Wastewater Infiltration into Soil and the Effects of Infiltrative Surface Architecture**, Small Flows Quarterly, Winter 2004, Vol. 5, No. 1, pp. 29, National Small Flows Clearinghouse, West Virginia University, WV 26506-6064.
60. Spooner, Jean; House, Halford C.; Hoover, Michael T.; Rubin, A. Robert; Silverthorne, Ray, Jr.; Steinbeck, Steve, J.; Harris, Vernon; Uebler, Robert, L.; Martin, Brett; **Performance Evaluation Of Innovative and Alternative Onsite Wastewater Treatment Systems In Craven County, NC**; Proceedings from the Eighth National Symposium on Individual and Small Community Sewage Systems; ASAE, 1998, pp. 458.
61. State of Wisconsin; **Chapter Commerce 83, Division of Building and Safety Administrative Code**, Department of Commerce, State of Wisconsin, 2004.
62. SWRCB, **Guidelines for Evapotranspiration Systems,** State Water Resources Control Board, 1001 I St., Sacramento, CA 95814, 1980.
63. SWRCB, **California Water News**, revised 1/23/07

64. SWRCB, **Review of Technologies for the Onsite Treatment of Wastewater in California**, prepared by H Leverenz, G Tchobanoglous, and J Darby, Center for Environmental and Water Resources Engineering, University of California Davis, UCD Code Report No. 02-02, 2002, 207 pages [e-file not available].
65. SWRCB, **Evaluation of Disinfection Units for Onsite Wastewater Treatment Systems**, prepared by H Leverenz, J Darby, and G Tchobanoglous, Center for Environmental and Water Resources Engineering, University of California Davis, UCD Code Report No. 2006-01, 2006
66. SWRCB, **Report of the Technical Advisory Committee for Onsite Sewage Disposal Systems**, State Technical Advisory Committee, November 1994, pp. 2.
67. Tchobanoglous, G. and Burton, F. L., **Wastewater Engineering Treatment, Disposal and Reuse**, Metcalf & Eddy, Inc., McGraw-Hill, Inc., New York, 1991.
68. Turfgrass Producers International, **Soil Preparation for a Beautiful lawn**, http://turfgrasssod.org; Turfgrass Producers International, 2 East Main, East Dundee, Illinois 60118.
69. Tsukuda, S. M., Ebeling, J.M., and Solomon, C., **Real-time Monitoring of Recirculation Sand and Peat Filters,** Proceedings from the Tenth National Symposium on Individual and Small Community Sewage Systems; ASAE, 2004, pp. 537.
70. Tyler, E.J. and Converse, J.C., **Soil Acceptance of Wastewater as Affected by Soil Morphology and Wastewater Quality**, Proceedings from the Seventh National Symposium on Individual and Small Community Sewage Systems; ASAE, 1994, pp. 185.
71. USDA, **Sewage and Sewerage of Farm Homes**, Farmers' Bulletin No 1227, U. S. Government Printing Office, Washington, D.C. 1924
72. USDA, Soil Survey Division Staff, **Soil Survey Manual**, United States Department of Agriculture, U.S. Government Printing Office, Washington, D.C. 20402
73. USEPA, **Onsite Wastewater Treatment Systems Manual**, EPA/625/R-00/008, February 2002, 367 pp. [e-file: epa_OWTSManual.pdf].
74. USEPA, **Onsite Wastewater Treatment and Disposal Systems**, EPA 625/1-80-012, October 1980. pp. 1
75. USEPA, **Response to Congress on Use of Decentralized Wastewater Treatment Systems**, EPA 832-R-97-001b, Office of Wastewater Management, United States Environmental Protection Agency, Washington, D.C., 1997
76. USEPA, **Environmental Effects of Septic Tank Systems**, EPA-6000/3-77-096, Scalf, Marion R and Dunlap, William J, Groundwater Research Branch, Ada, OK and Kreissl, James F., Systems and Engineering Evaluation Branch, Cincinnati, OH; Robert S. Kerr Environmental Research Laboratory, USEPA, Ada, OK
77. Ver Hey, Margaret E. and Woessner, William W., **Documentation of the Degree of Waste Treatment Provided by Septic Systems, Vadose Zone and Aquifer In Intermontane Soils Underlain by Sand and Gravel**, Proceedings from the Fifth National Symposium on Individual and Small Community Sewage Systems; ASAE, 1987, pp. 77.
78. Verstraeten, Ingrid M., Fetterman, Greg S., Selbree, Sonja K., Meyer, M.T., and Bullen, T.D., **Is Septic Waste Affecting Drinking Water From Shallow Domestic Wells Along the Platte River in Eastern Nebraska?**, Fact Sheet 072-03, U. S. Geological Survey, U.S. Department of the Interior, January 2004.
79. Whitehead, J., Geary, P., and Patterson, R.A., **Skills to Assess the Suitability of Sites for Onsite Wastewater Disposal**, Environmental Health Review, Volume 28. May 1999, 5 pp [e-file: P35-health.pdf].

80. Winkler, E.S. and Veneman, P.L.M., **A Denitrification System for Septic Tank Effluent Using Sphagnum Peat Moss**, Proceedings from the Sixth National Symposium on Individual and Small Community Sewage Systems; ASAE, 1991, pp. 155.
81. Winneberger, J.T. **Septic-Tank Systems,** Ann Arbor Science, Butterworth Publishers, 80 Montvale Ave., Stoneham, MA 02180, 1984.
82. Woessner, W.W. and Ver Hey, M. E., **Water Quality Management Options for a Coarse Alluvial Western Mountain Valley Aquifer Impacted by Septic System Wastes**, Proceedings from the Fifth National Symposium on Individual and Small Community Sewage Systems; ASAE, 1987, pp. 329.

APPENDIX: SWRCB RESPONSES TO COMMENTS